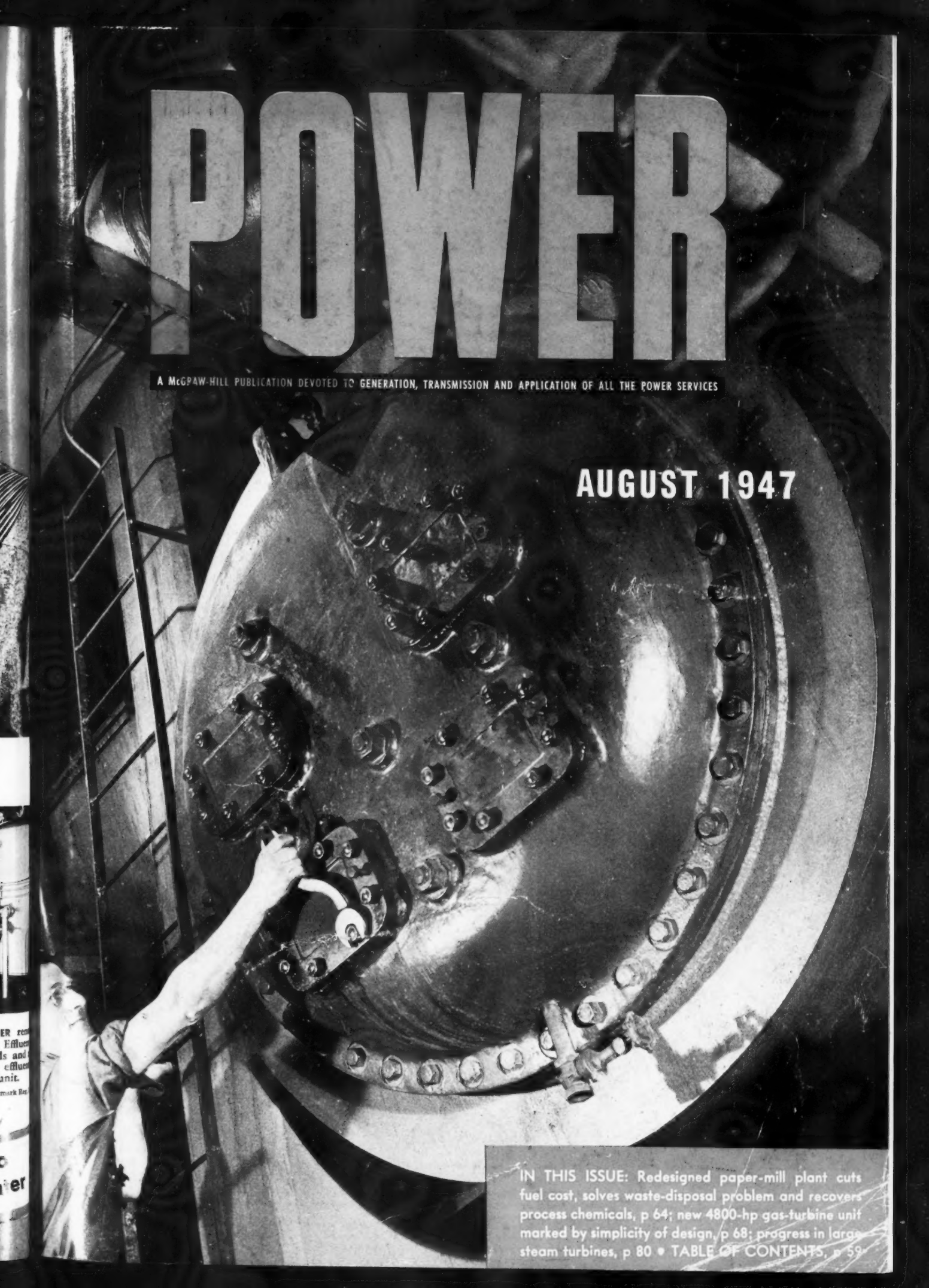
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

AUGUST 1947



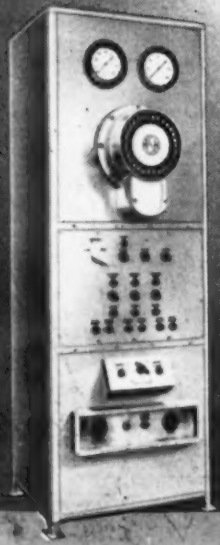
IN THIS ISSUE: Redesigned paper-mill plant cuts fuel cost, solves waste-disposal problem and recovers process chemicals, p 64; new 4800-hp gas-turbine unit marked by simplicity of design, p 68; progress in large steam turbines, p 80 • TABLE OF CONTENTS, p 59

A Feather IN YOUR Cap

Wouldn't it be "a feather in your cap" if you could tell your management:

1. **You could handle all the dust in the plant automatically**
2. **Savings would pay for the complete installation in months**
3. **Every year it would pay big dividends on the investment**

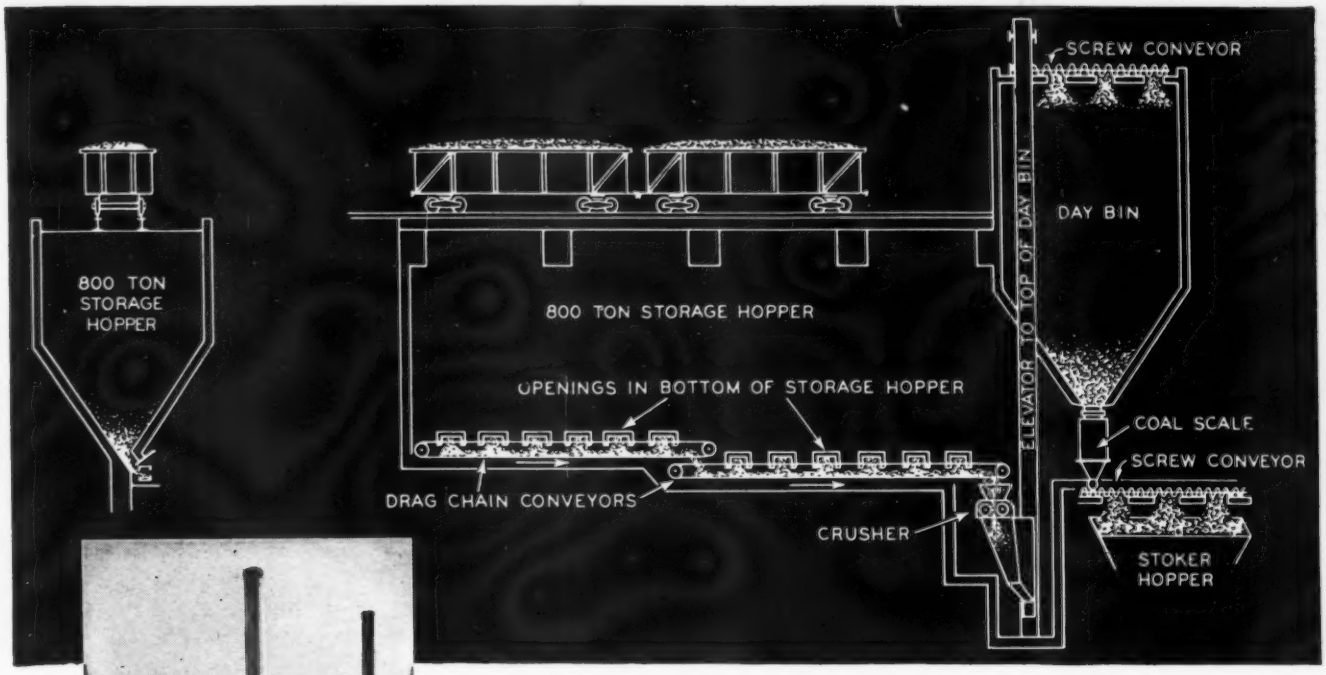
All you need do is have our representative explain the new Automatic Hydrovac System; then you take the amazing facts to management and you get the "feather." We have representatives in most principal cities. Write us. The Allen-Sherman-Hoff Co., 227 South 15th St., Philadelphia 2, Pa.



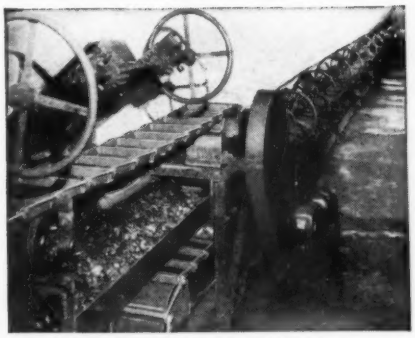
Automatic Sequence Head, the brain controlling the Automatic Hydrovac. Its reliability is uncanny and absolutely foolproof.

ASH

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), August, 1947, Vol. 91, No. 8, Published monthly with an additional Directory in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 N. Broadway, Albany 1, N.Y. Editorial and executive offices, 330 W. 42nd St., New York 18, N.Y. Entered as second class matter August 25, 1936, at Albany, N.Y., under the act of March 3, 1879. Printed in U.S.A. Allow at least 10 days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 W. 42nd St., New York 18, N.Y. Subscription rates, U.S. and U.S. possessions, $5 for one year, $8 for two years. 50c per single copy. Canada, $6 for one year, $9 for two years. Pan American countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.



Central States Electric utilizes topography in Coal Handling



Showing Link-Belt "H" Class drag chain conveyors which take coal from bottom of track storage hopper to crusher.

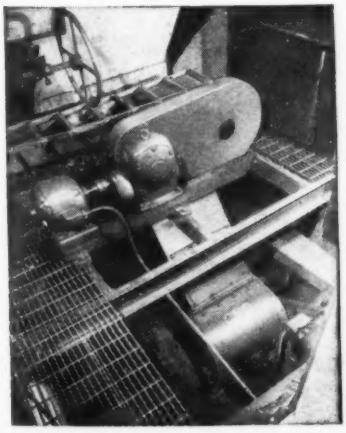
This unusual layout again demonstrates the ability of Link-Belt to engineer and apply equipment to specific conditions for high efficiency and low handling cost.

The hilly nature of the topography was utilized in laying out the coal handling system for Central States Electric Company, Iowa Falls, Iowa. Coal is received at a higher level than the boilers, and goes into a storage hopper holding 800 tons.

A Link-Belt drag chain conveyor takes the coal from the hopper bottom to a crusher, then to a day bin holding 80 tons. From this bin the coal is delivered by screw conveyor through automatic weighing devices to the stoker-spreader conveyor. The stoker has speed regulation in response to load variation, operating through Link-Belt P.I.V. Gear.

The engineering department of Central States Electric Company cooperated with Link-Belt engineers in the development of this layout.

Let us consult with you on your coal and ashes handling layout and equipment problems.



Showing drive arrangement of drag chain conveyor and crusher.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 10,791

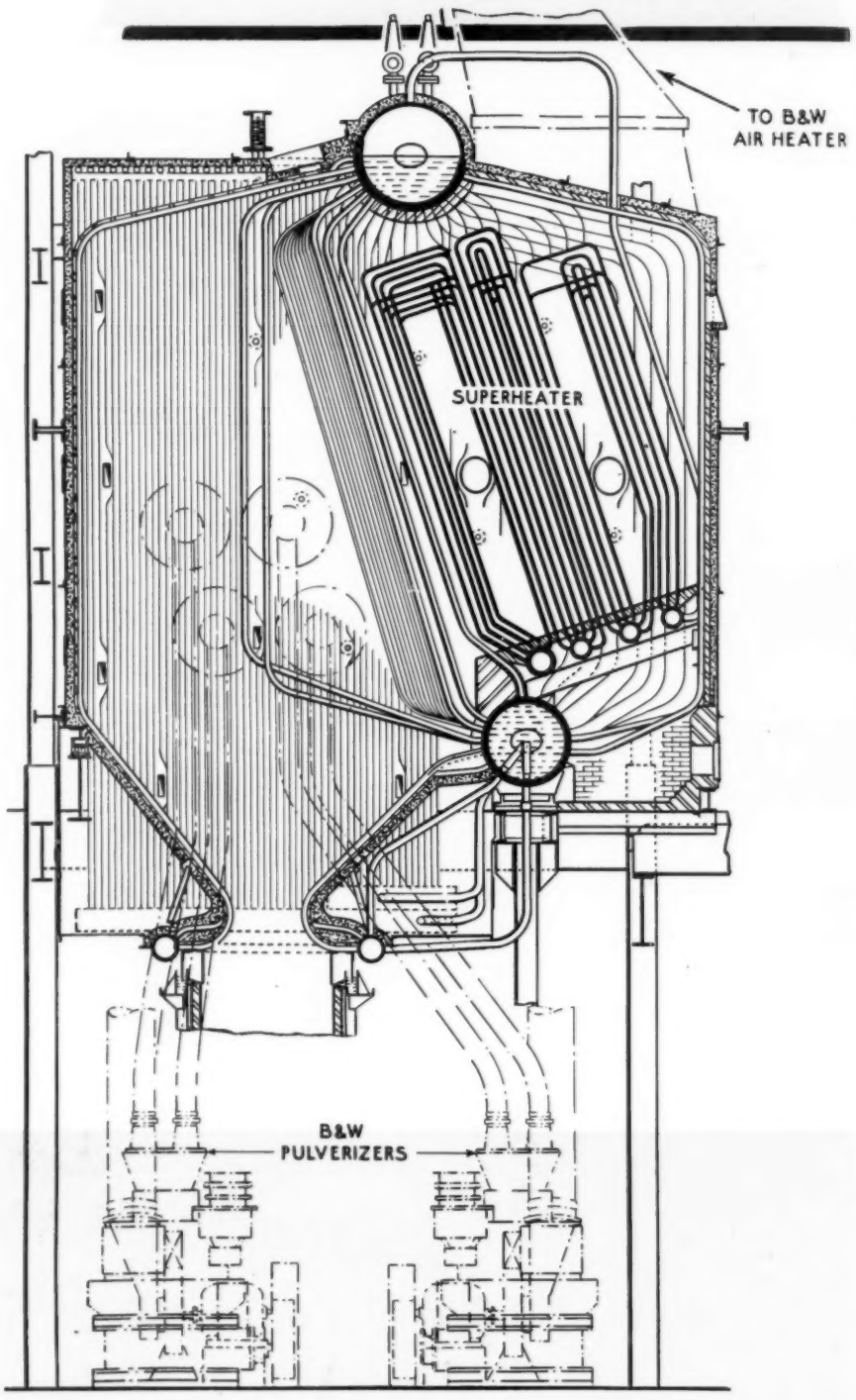
LINK-BELT

THE SYMBOL OF QUALITY · LB · LINK-BELT

COAL AND ASHES HANDLING EQUIPMENT

MORE PROOF...

THAT BOILER



B&W Integral-Furnace boiler installed in the Wyandotte Chemicals Corporation North Plant. Maximum continuous steam capacity, 200,000 lb. per hour at 900 psi and 875F. Fired by pulverized coal and coke-oven gas.

MODERNIZATION PAYS...

MORE BYPRODUCT POWER
IN SAME SPACE . . . WITH LESS FUEL
AT WYANDOTTE

Electric demands were growing faster than heating and process steam loads at the North Plant power station of Wyandotte Chemicals Corporation.

PROBLEM To increase power load without producing more process and heating steam than needed.

SOLUTION Topping of existing low-pressure equipment, including installation of new B&W Integral-Furnace Boiler and new high-pressure prime mover.

RESULT Ratio of byproduct power to steam load substantially increased with least investment. Fuel costs reduced. New boiler produces four times more steam than each of the old units, yet occupies no more floor space.

G-340T

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . Air Heaters . . Economizers . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners Chain-Grate Stokers . . . Stacks and Breechings . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . Chemical Recovery Units . . . Alloy Castings.

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OTHER B&W PRODUCTS — Marine Boilers . . . Pressure Vessels . . . Process Equipment.

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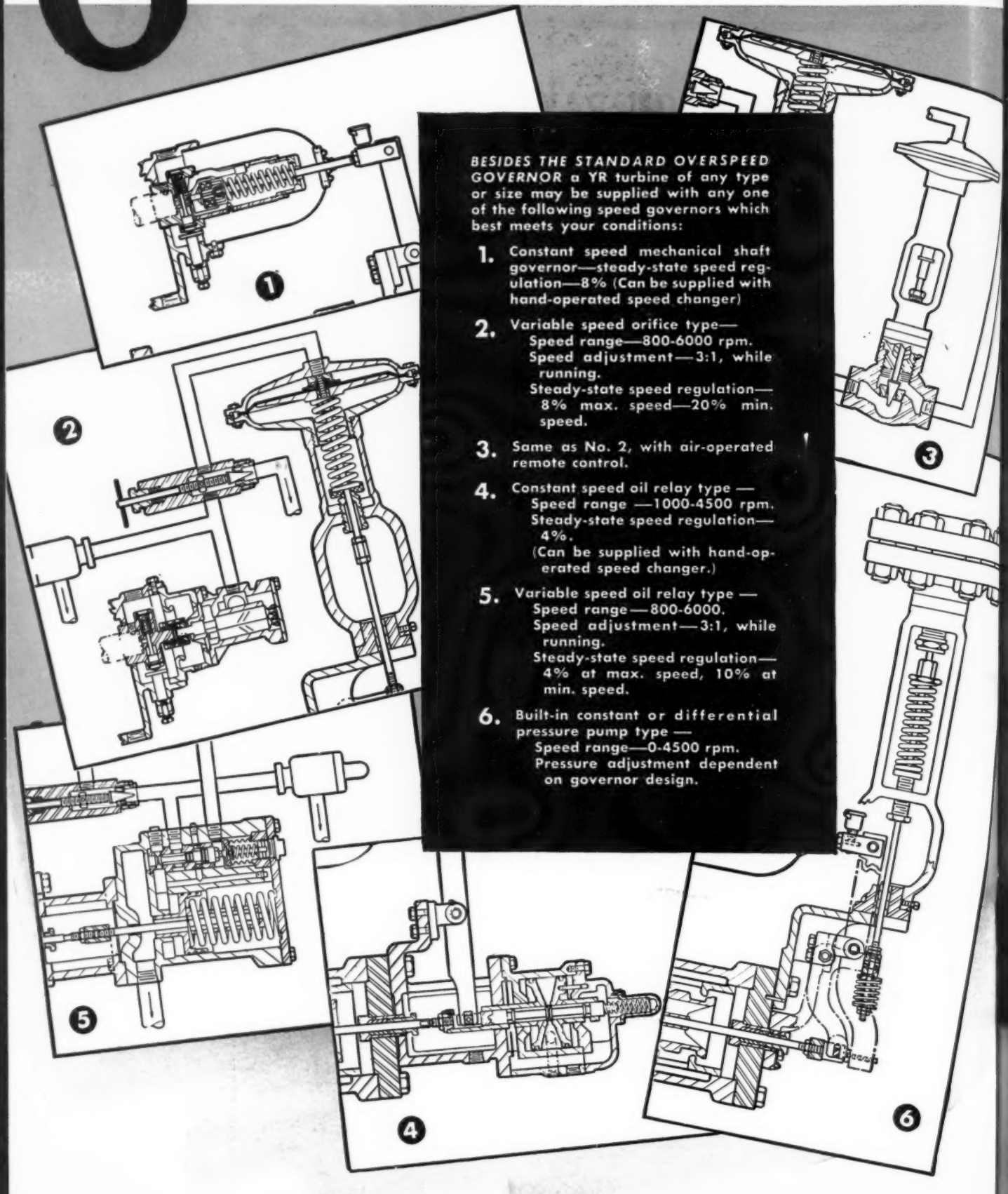
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

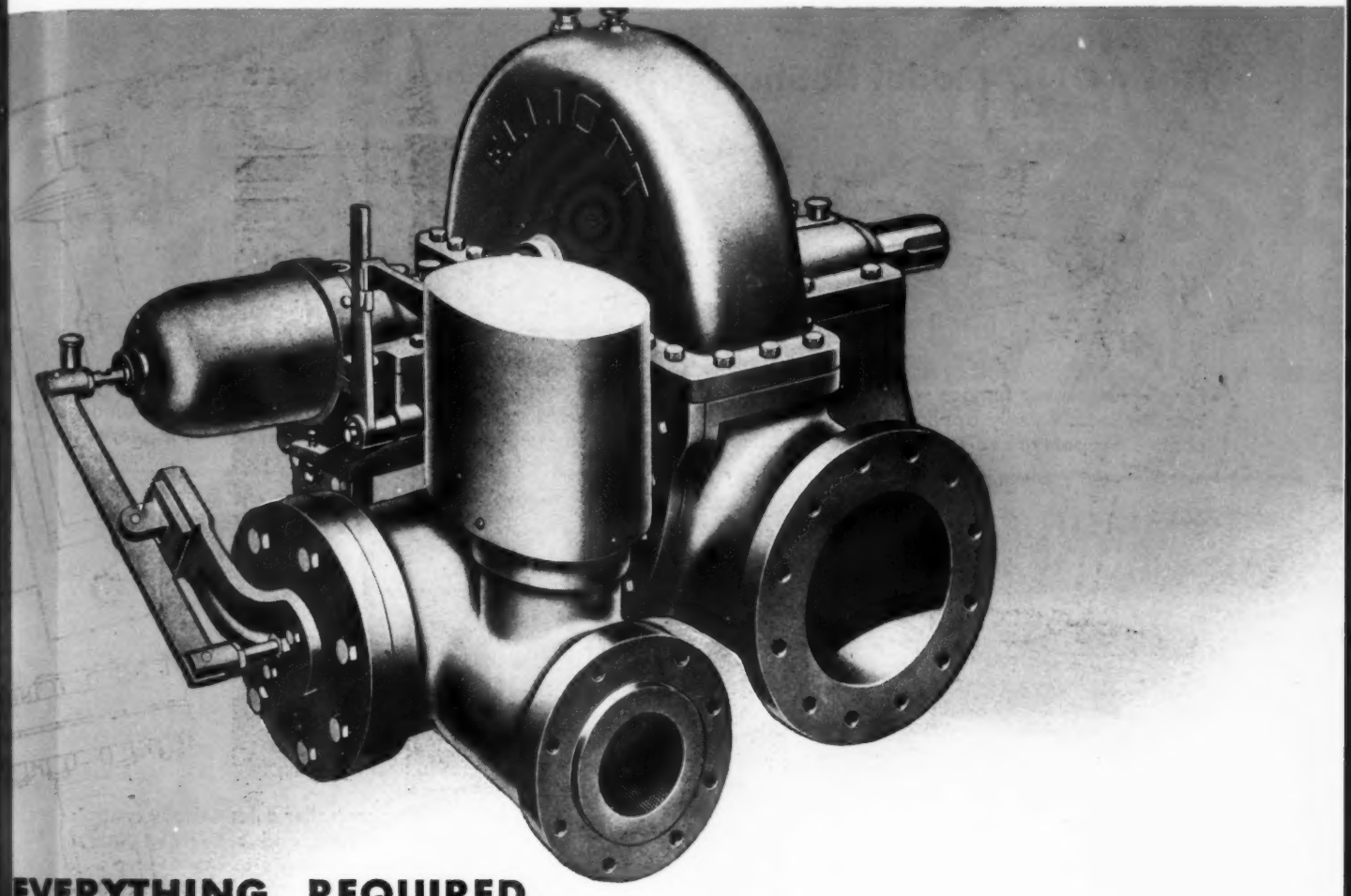
6 ELECTIVE GOVERNORS *offered*



BESIDES THE STANDARD OVERSPEED GOVERNOR a YR turbine of any type or size may be supplied with any one of the following speed governors which best meets your conditions:

1. Constant speed mechanical shaft governor—steady-state speed regulation—8% (Can be supplied with hand-operated speed changer)
2. Variable speed orifice type—
   Speed range—800-6000 rpm.
   Speed adjustment—3:1, while running.
   Steady-state speed regulation—8% max. speed—20% min. speed.
3. Same as No. 2, with air-operated remote control.
4. Constant speed oil relay type —
   Speed range —1000-4500 rpm.
   Steady-state speed regulation—4%.
   (Can be supplied with hand-operated speed changer.)
5. Variable speed oil relay type —
   Speed range—800-6000.
   Speed adjustment—3:1, while running.
   Steady-state speed regulation—4% at max. speed, 10% at min. speed.
6. Built-in constant or differential pressure pump type —
   Speed range—0-4500 rpm.
   Pressure adjustment dependent on governor design.

for the new "YR" Turbine



EVERYTHING REQUIRED
in a mechanical drive turbine

Eight different turbine types . . . Capacities to 2000 hp . . . Speeds to 6000 rpm . . . Backpressures through 250 psig . . . Centerline support . . . High Speed liner type bearings . . . Packing glands removable individually . . . Wide variety of standardized modifications to serve almost any operating condition . . . and with all this, the same rugged reliability that has for years characterized Elliott mechanical drive turbines. Bulletin H-16 gives full details—write.

Elliott COMPANY

***Steam Turbine Department*, JEANNETTE, PA.**

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
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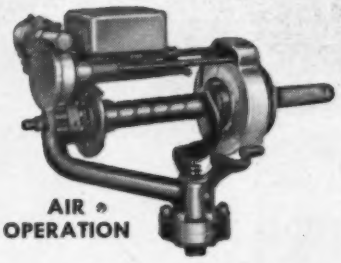
DISTRICT OFFICES IN PRINCIPAL CITIES

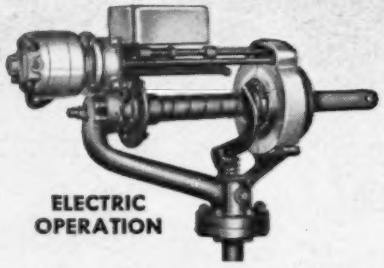
R-710

Efficient BOILER OPERATION

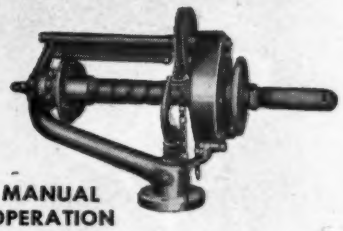
DIAMOND Model IR Short Retracting Soot Blowers



AIR OPERATION



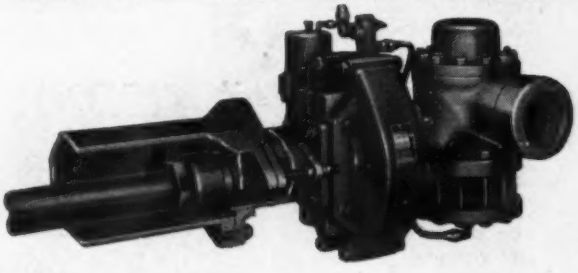
ELECTRIC OPERATION



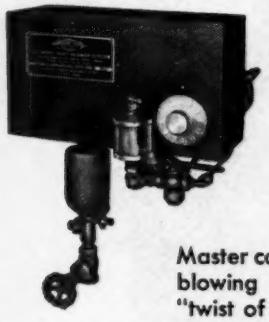
MANUAL OPERATION

For cleaning either furnace walls or boiler heating surfaces where gas temperatures exceed limit for permanently installed units. Equally applicable to compressed air or steam as cleaning medium. Important advantages include: positive poppet type valve, 12″ travel, no lubrication, 360° blowing without additional advance of nozzle, simple, etc.

DIAMOND Model A2E Automatic Air Puff Soot Blowers

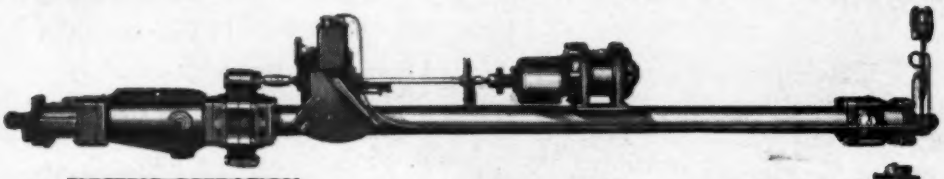


Cleans heating surfaces by series of compressed air puffs delivered through standard multiple nozzle blowing element. Spreading cleaning cycle over longer time permits smaller compressor and receiver . . . also eliminates stack discharge nuisance.

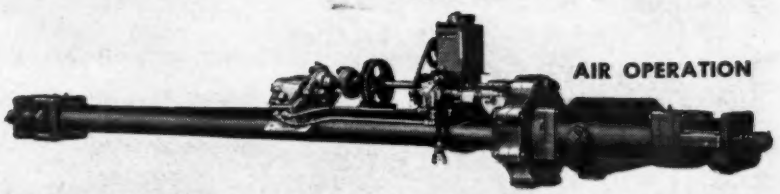


Master controller automatically controls blowing time and sequence. Just a "twist of the wrist" to open valve . . . controller does rest. Automatic control assures correct boiler cleaning.

DIAMOND Telescopic Retracting Soot Blowers



ELECTRIC OPERATION



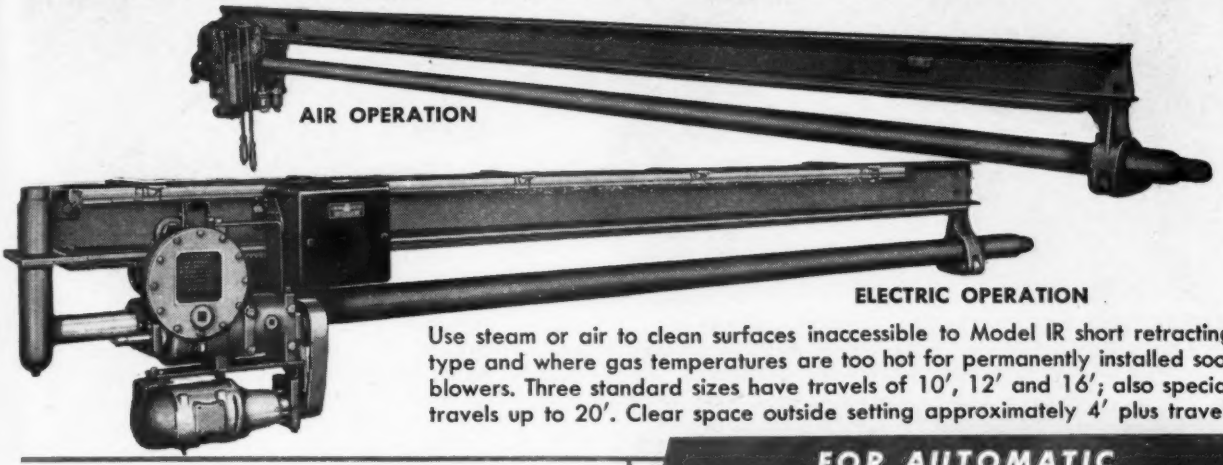
AIR OPERATION

Used where insufficient clear space outside boiler will not permit installation of Model IK retracting blower for cleaning surfaces inaccessible to short retracting blower and where gas temperatures are too hot for permanently installed units. Standard 16′ travel requires approximately 12′ clear space outside boiler; special travels up to 20′. Uses air or steam as cleaning medium.

DIAMOND POWER SPECIALTY CORP.

REQUIRES THE SELECTION OF SOOT BLOWERS THAT EXACTLY SUIT YOUR INDIVIDUAL REQUIREMENTS

DIAMOND Model IK Long Retracting Soot Blowers

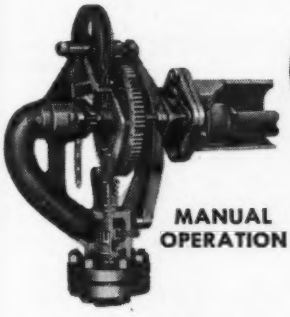


AIR OPERATION

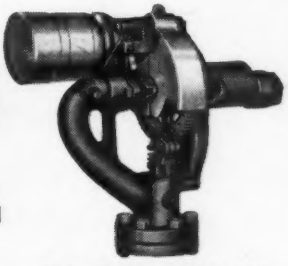
ELECTRIC OPERATION

Use steam or air to clean surfaces inaccessible to Model IR short retracting type and where gas temperatures are too hot for permanently installed soot blowers. Three standard sizes have travels of 10′, 12′ and 16′; also special travels up to 20′. Clear space outside setting approximately 4′ plus travel.

DIAMOND Model G9B Soot Blower

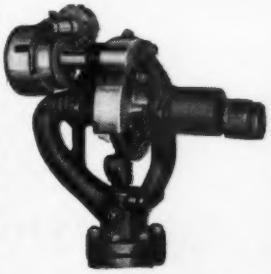


MANUAL OPERATION



ELECTRIC OPERATION

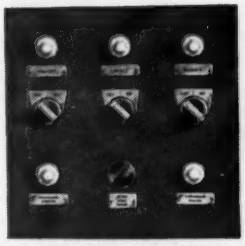
Uses steam as cleaning medium through multiple nozzle blowing element permanently installed inside setting. "Automatic Valved" requiring only one continuous operation to open and close valve in head and simultaneously rotate element. Other important features: adjustable pressure control unit, clockwise or counterclockwise rotation, 360° blowing arc, etc.



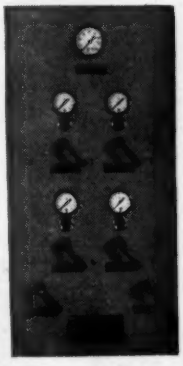
AIR OPERATION

FOR AUTOMATIC SEQUENTIAL SOOT BLOWING

Correct cleaning is always assured and labor is saved. "Human element" is eliminated as operator normally only presses start button or opens master control valve. Each blower unit must operate in correct sequence and at right speed every time. No blower can be overlooked or incorrectly operated. Labor is saved because no need for attendant to warm up piping, drain it, and then operate each blower unit manually. Blower grouping can sectionalize heating surface into zones to maintain normal heat absorption by different frequency of group operation. System can be completely air or electric operated and controlled . . . or combination of both.



DIAMOND ELECTRIC CONTROL PANEL



DIAMOND AIR CONTROL PANEL

DIAMOND SOOT BLOWERS . . .
the Most Complete Line

DETROIT 31, MICH. • DIAMOND SPECIALTY LIMITED—Windsor, Ontario

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Here are the benefits you get from

BAILEY CONTROLS

1. **Fuel Conservation without decrease in output.**
2. **Lower Cost Steam.**
3. **Increased Safety for Plant and Personnel.**
4. **Better Power Service.**

Bailey Controls for boilers make the important factors of steam plant operation work together to insure ideal performance.

In order that all of these factors may be regulated in harmony with each other and the load demand, Bailey Controls are carefully engineered to the requirements of the units which they serve.

Bailey engineering service starts with the selection of suitable metering and control equipment and continues through the design, construction, calibration, installation and final adjustment on the job. Bailey field engineers are stationed in over thirty industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense.

The Bailey engineer in your community has extensive experience at his command, which includes tests on thousands of boiler installations, covering a wide range of fuels, furnaces and fuel burning equipment. He is in a position to help you secure the many benefits resulting from intelligent use of correctly selected and properly applied boiler control.

Bailey Controls for boiler operation are described in Bulletin 15-C. Write for your copy to Bailey Meter Company, 1036 Ivanhoe Road, Cleveland 10, Ohio —in Canada to Bailey Meter Company Limited, Montreal.

FUEL CONVERSION

If it becomes desirable or necessary to convert to another fuel, Bailey Controls can be adjusted easily to insure optimum results from the new fuel.

G-26

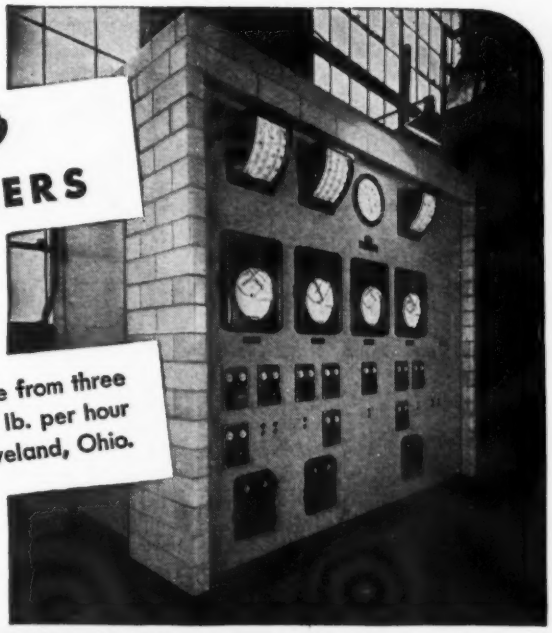
BAILEY METER COMPANY

1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Controls for Steam Plants

APPLICATION to STOKER FIRED BOILERS

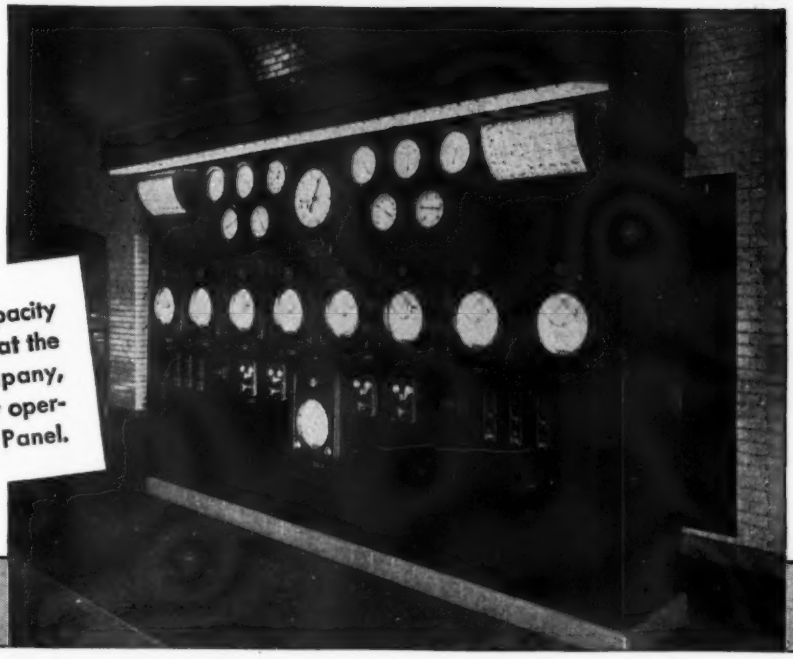


UNDERFEED

This Bailey Control Panel insures optimum performance from three underfeed stokers on two 25,000 and one 40,000 lb. per hour capacity boilers at Parker Appliance Company, Cleveland, Ohio.

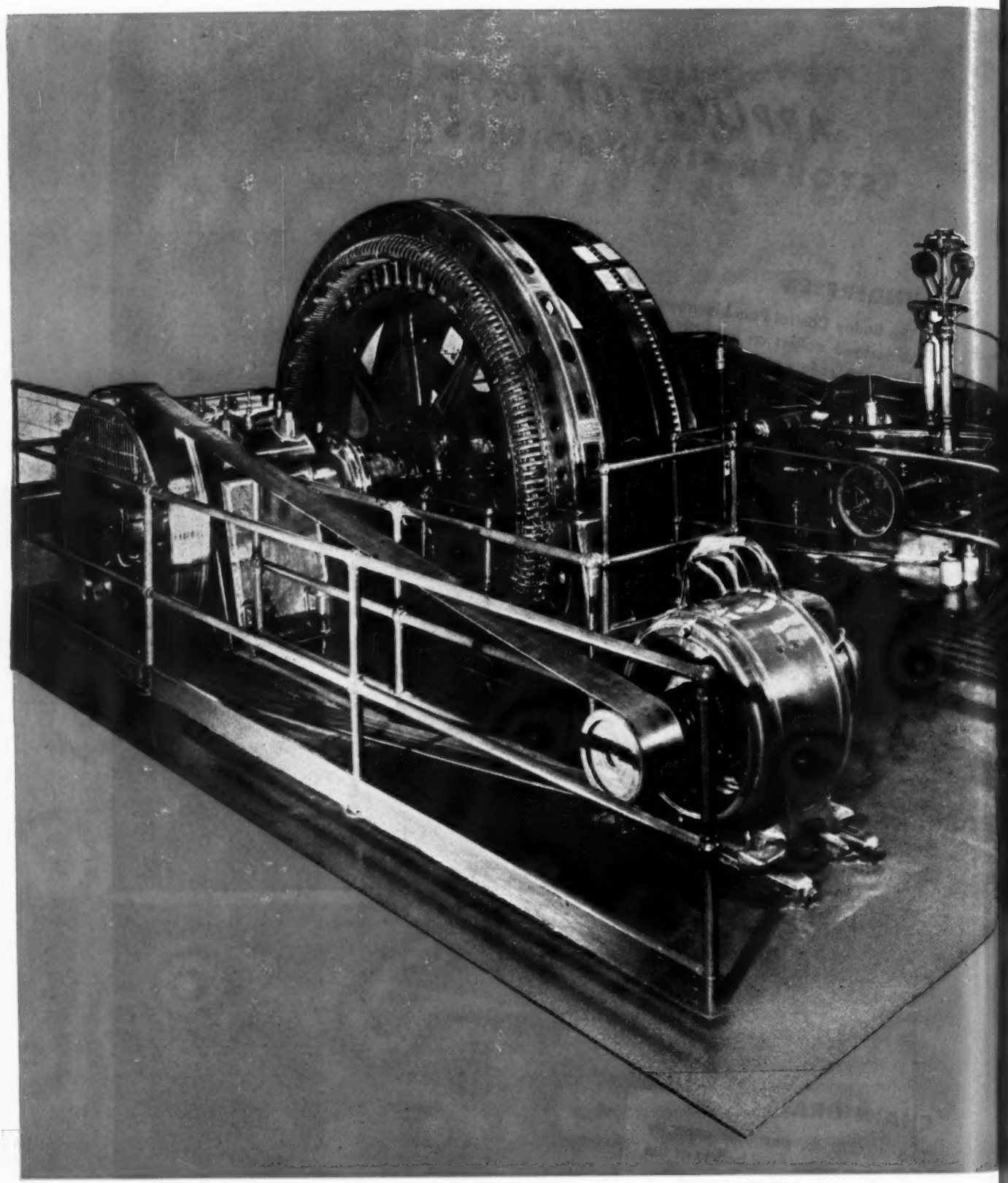
SPREADER

Bailey Controls help operators at Graham-Paige Motors Corporation, Detroit, Michigan, to maintain tests standards in everyday operation of this 60,000 lb. per hour boiler fired by a spreader type stoker.



CHAIN GRATE

Two 40,000 lb. per hour capacity chain grate stoker fired boilers at the United States Tobacco Company, Chicago, Illinois, are efficiently operated by this Bailey Control Panel.



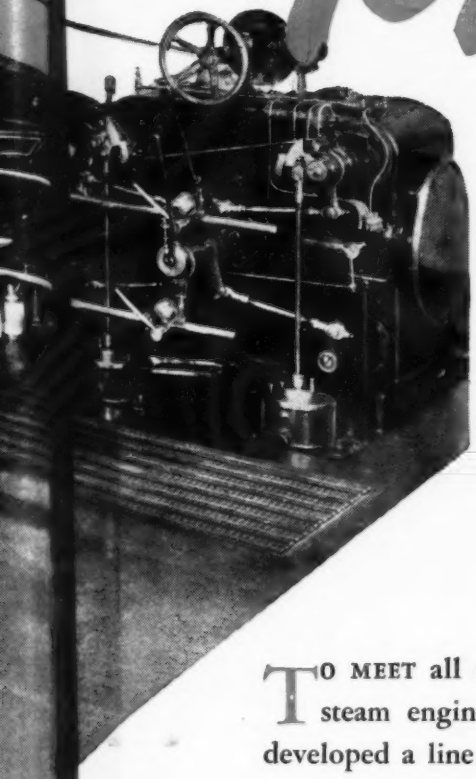
Tune in . . .
TEXACO STAR THEATRE
presents the NEW
TONY MARTIN SHOW
every Sunday night.
See newspaper for time
and station.

TEXACO

REG. T. M.

TEXACO

USE THE RIGHT OIL...GET *More Power*



TO MEET all the varied conditions of steam engine operation, Texaco has developed a line of highly efficient steam cylinder oils. Whatever the type of your engine . . . whatever your operating conditions . . . you can be sure of effective lubrication with Texaco.

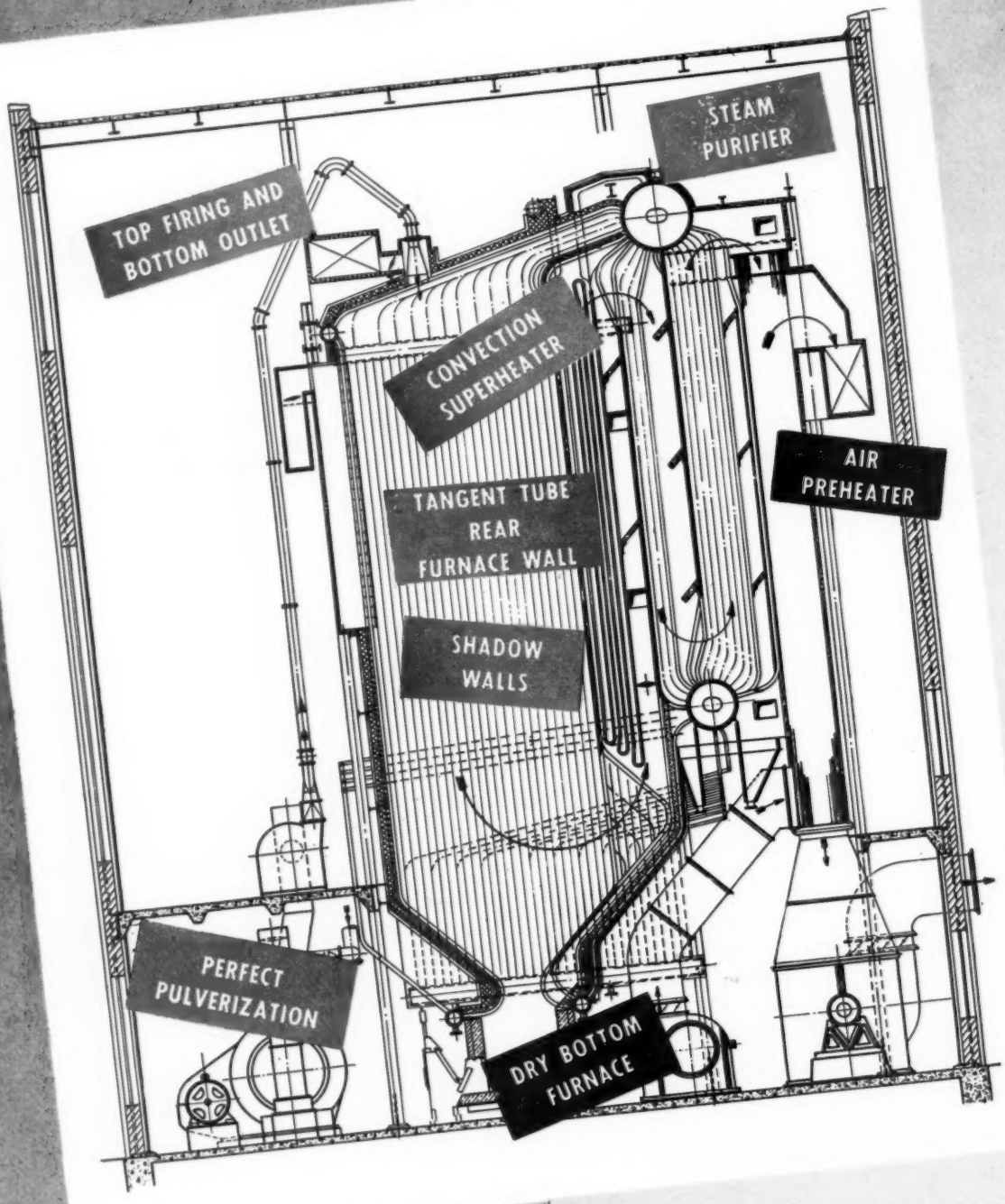
Texaco steam cylinder oils atomize completely and cling to cylinder walls, resisting the washing effect of moisture. They assure long-lasting protection against wear . . . keep rings steam-tight . . . promote proper valve action . . . help your engines, new or old, develop full power.

Best steam engine performance comes from using the right lubricants *right*. Follow the recommendations of a Texaco Lubrication Engineer. Call the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

STEAM CYLINDER OILS

FOR EVERY STEAM CONDITION

KVS ENGINEERED



NO. 6 OF A SERIES

See JULY "POWER" for description of SUPERHEATERS

STEAM PURIFICATION

...assures extremely low moisture content and impurity carryover

The KVS cyclone type steam dryer and purifier produces steam in which the impurity carryover is less than .5 parts per million and the moisture content less than ¼ of 1% with 100% feed water make up.

Recontamination of boiler water is eliminated in the KVS Cyclone System by collecting solids and removing them from the boiler. These solids are then passed through heat recovery equipment.

Installation of KVS steam purifying equipment is arranged to avoid interference with boiler tube servicing.

The KVS Cyclone Steam Purification System is designed to meet individual requirements, insuring maximum operating efficiency at all boiler ratings.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.

KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance-proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

Kennedy-Van Saun

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FOR SIMPLIFIED PLANT-DISTRIBUTION

Specify

INTERLOCKED-ARMOR

ELIMINATES CONDUIT, PULL BOXES, FANCY

You can install power cable in your plant for either primary or secondary circuits that need no conduit, pull boxes, or detailed circuit layout. Use of G-E No. 1799 Varnished-cambric Interlocked-armor Cable makes possible a simplified system that is easily re-used in changed circuits, is quicker to install, costs less money, and results in higher machine output than conduit systems.

This cable is self-protected by its flexible steel armor. It can easily be bent around beams and other obstructions, frequently requiring only a one-line diagram as an installation guide. The saving in materials and labor frequently cuts the total cost to less than half the expense of a conduit system. In addition, high salvage value cuts the cost of circuit changes to meet varying load conditions, and improved voltage regulation due to closer spacing of conductors increases machine output.

For more information on interlocked-armor cable, call your nearest G-E representative for Bulletin GEA-4507, or write to General Electric Company, Apparatus Department, Schenectady 5, N. Y.

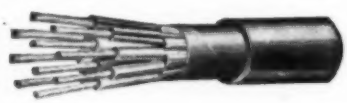
Interlocked Armor is one of six modern cables mass produced and authorized for warehouse stock. Standard designs permit quicker delivery and a lower price than special types. Each offers advantages in its recommended applications.

CORONOL*-GEOPRENE

For high-voltage power distribution. Has superior resistance to heat, corona, and aging. Bulletin GEA-1788.

VERSATOL*-GEOPRENE

For low-voltage distribution and branch circuit wiring to motors and controls. Resists wear and heat aging. H.B.1240, p. 3.



FLAMENOL*

For low-voltage wiring. Its chemically inert insulation resists water, cutting oils, acids, and alkalies, and is flame resistant. Bulletin GEA-4352.

VARNISHED-CAMBRIC LEADED

For high-voltage feeders, distribution in underground ducts. Ideal for heavy loads in wet locations. Bulletin GEA-2623.

GEOPRENE PORTABLE

For power to portable shovels, pumps, construction machinery where resistance to rough handling and excessive flexing is needed. H.B.1261.

**Trademark reg. U.S. Patent Office*

CABLE

CIRCUIT LAYOUTS

PAUL WILLIAMSON,

Chief Engineer, Woolrich Woolen Mills, says,

"I'd say it takes about a third as many man-hours to install G-E interlocked as it does to put up a conduit job. That's because interlocked is lighter weight, takes less space, and is flexible and easier to handle . . .

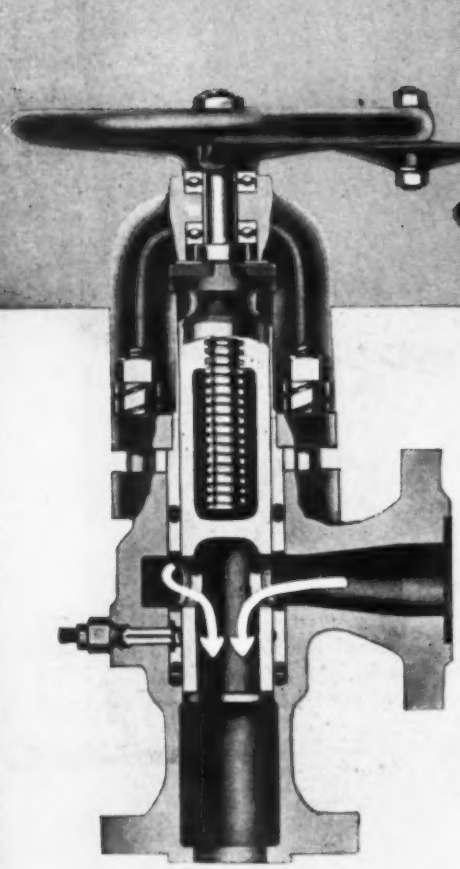
"Last summer our crew put in a complete installation of 512 feet in three and one-half hours! What's more, it's a good-looking, neat job, and there to stay."

GENERAL ELECTRIC

502-64-1200

4

HIGH PRESSURE BOILER PLANTS



YARWAY TYPE "C" SEATLESS ANGLE VALVE
Open position. Notice balanced sliding plunger design. For pressures from 400 to 2500 psi.

YARWAY HARD-SEAT STRAIGHTWAY VALVE
Open position. A worthy companion to the Yarway Seatless Valve for tandem use on higher pressures. For pressures from 400 to 2500 psi.

YARWAY

OUT OF 5

USE YARWAY BLOW-OFF VALVES

It's a fact! Four out of every five high pressure boiler plants in the United States are equipped with Yarway Blow-Off Valves.

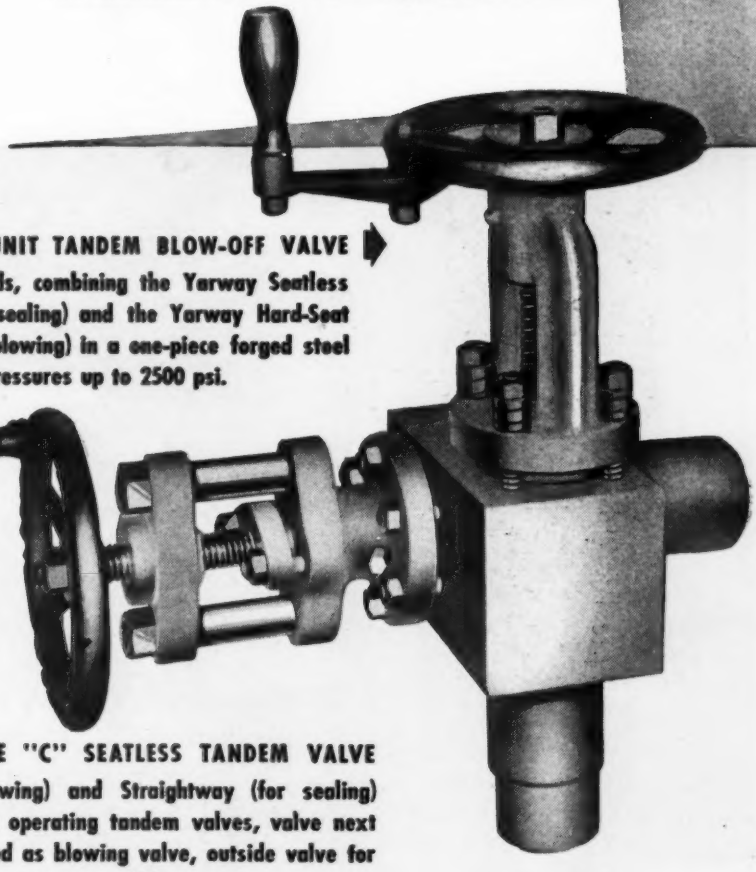
Why such an overwhelming acceptance? *Dependable performance.*

The proved performance of Yarway Blow-Off Valves is due to outstanding design, sound engineering and careful manufacture.

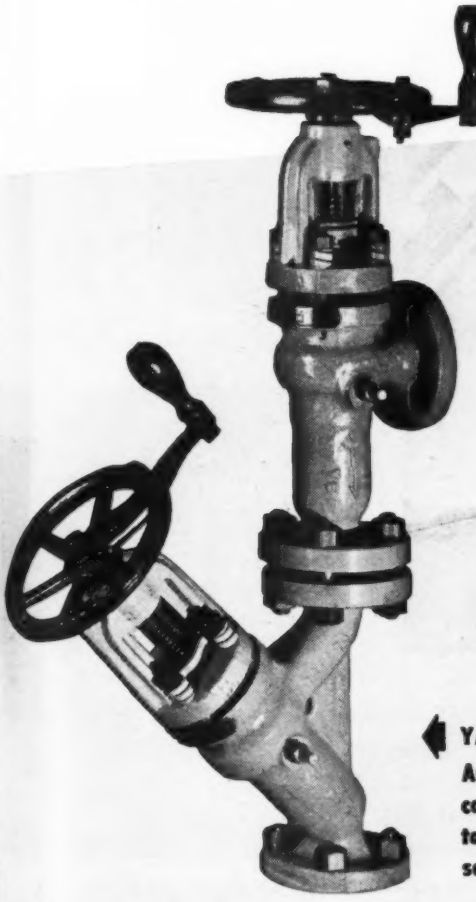
The famed Yarway *Seatless* principle eliminates a major source of blow-off valve trouble. Yarway Seatless Valves have no seat to score, wear, clog and leak. And constant research, leading to mechanical and metallurgical advancements, keeps Yarway valves ever ahead of changing service requirements.

Next time you order blow-off valves, remember—power engineers vote 4 to 1 for Yarways. You'll find all the details in Yarway Bulletin B-432.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.



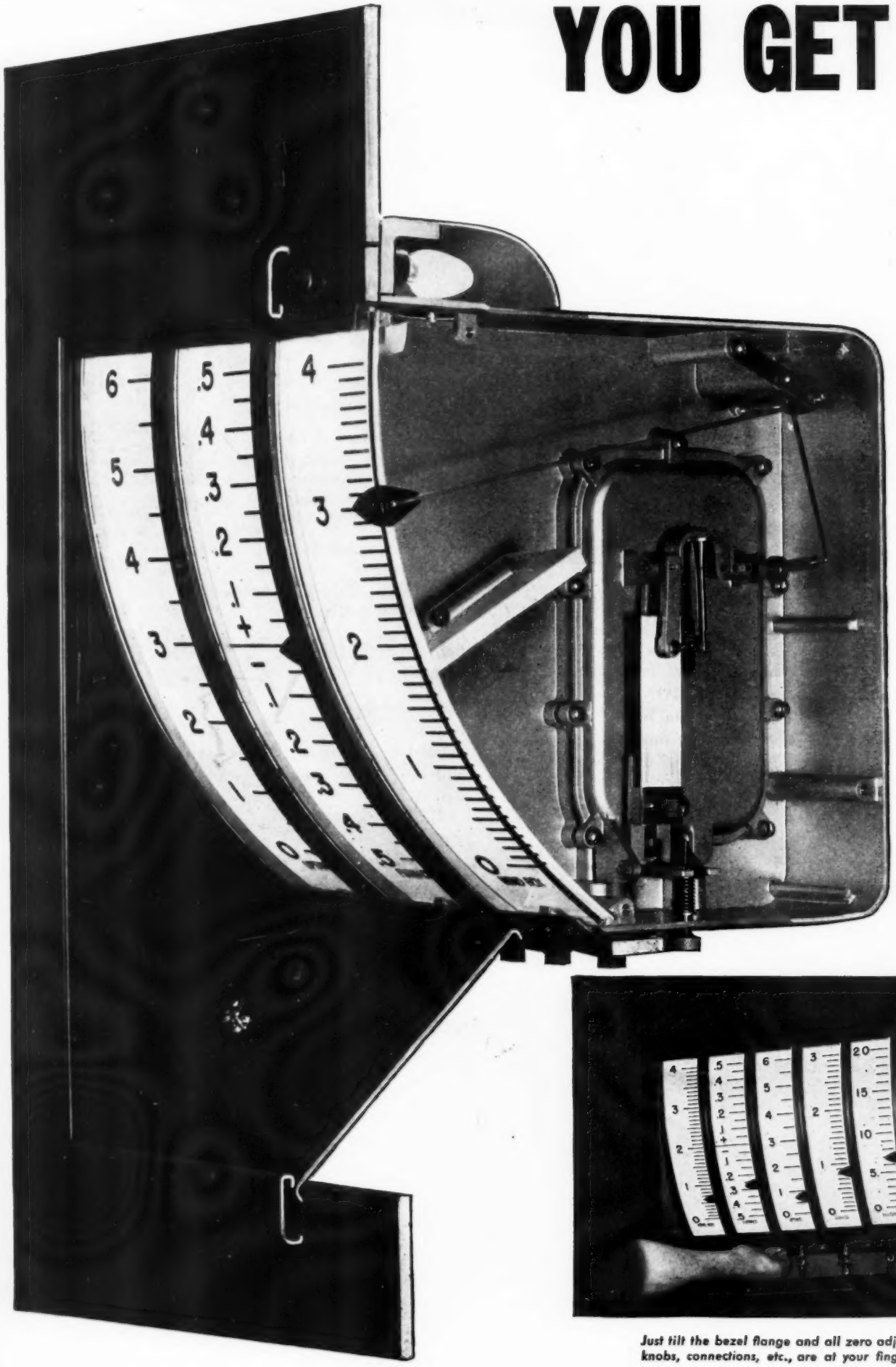
YARWAY UNIT TANDEM BLOW-OFF VALVE
Welding ends, combining the Yarway Seatless Valve (for sealing) and the Yarway Hard-Seat Valve (for blowing) in a one-piece forged steel body. For pressures up to 2500 psi.

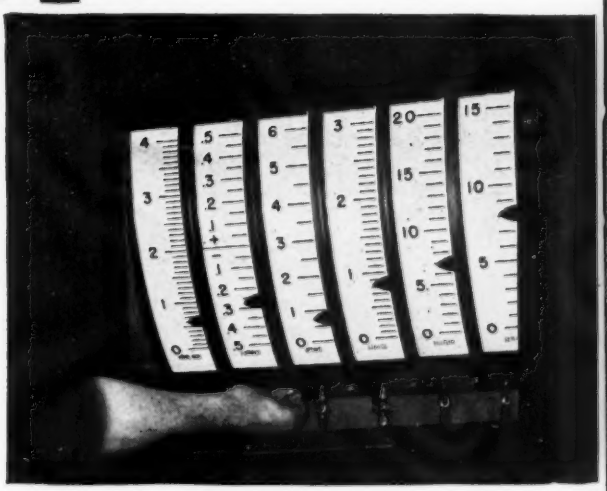


YARWAY TYPE "C" SEATLESS TANDEM VALVE
Angle (for blowing) and Straightway (for sealing) combination. In operating tandem valves, valve next to boiler is used as blowing valve, outside valve for sealing. For pressures up to 600 psi.

BLOW-OFF VALVES

YOU GET





Just tilt the bezel flange and all zero adjustment knobs, connections, etc., are at your finger tips

ALL OF THESE FEATURES

In The Republic Multi-Point Draft and Pressure Gage

1. EASY TO OPERATE: All adjustments can be made from the front of the gage regardless of whether it be flush or projected mounted. On the flush mounted gage a bezel flange, which tilts back, conceals the zero adjusting knobs, pipe connections, mounting bolts, etc.

2. INDIVIDUAL UNITS: Each draft or pressure element is individually housed in a die cast case forming a complete compact unit.

3. UNITS EASILY REMOVED: The individual units can be removed from the front of the gage as you would remove a book from a shelf. This can be easily and quickly done without interfering with the operation of any other unit.

4. EASY TO MAINTAIN: Because each element is a complete unit in itself which can be easily removed, maintenance is greatly simplified.

5. INDIVIDUAL ILLUMINATION: Each scale is individually illuminated from the back by a light located outside of the element housing.

6. UNIFORM SIZE: All units are of one standard size which permits new units to be added or interchanged as required.

7. ALL STANDARD RANGES: Elements are supplied for all standard ranges of draft, pressure or differential.

8. SENSITIVE DIAPHRAGM: All elements, except those for high pressures, are actuated by an extremely sensitive bellows type of diaphragm.

9. MULTIPLE UNITS: Any number of units of draft, pressure or differential may be combined in one multi-point gage which is supplied for either flush or projected mounting.

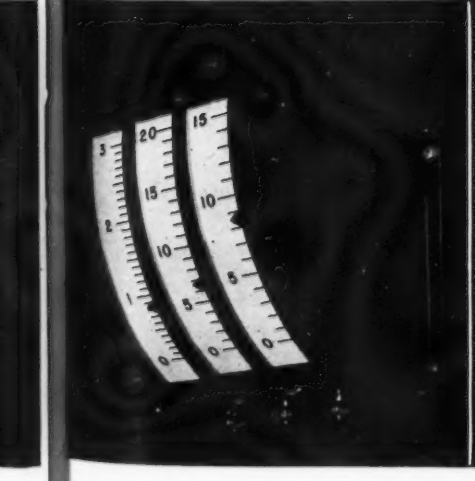
10 FLOW, CO_2, TEMPERATURE: Developed primarily to indicate drafts, pressures and differentials, the Republic multi-point gage can also be made to indicate other quantities such as flow, CO_2, temperature, liquid level, etc. In each case the corresponding standard Republic instrument is used.

The sectional view shown on the opposite page illustrates the extreme simplicity and compactness of the Republic Multi-Point Draft and Pressure Gage. Every detail has been designed to assure ease of maintenance and continuous operation as well as accuracy and sensitivity.

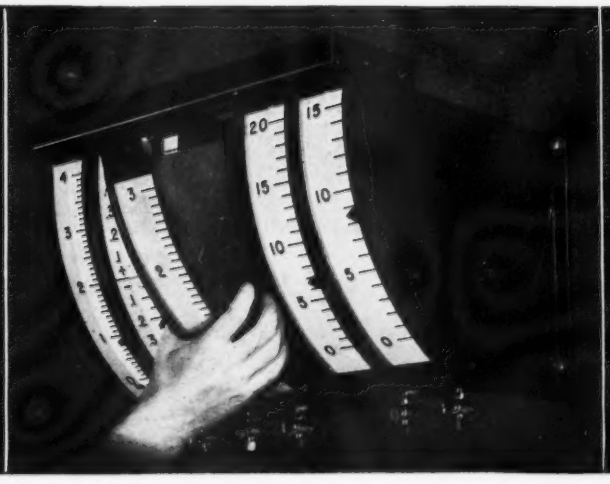
Write for a copy of Bulletin No. 802

REPUBLIC FLOW METERS CO.

2222 DIVERSEY PKWY. CHICAGO 47, ILLINOIS



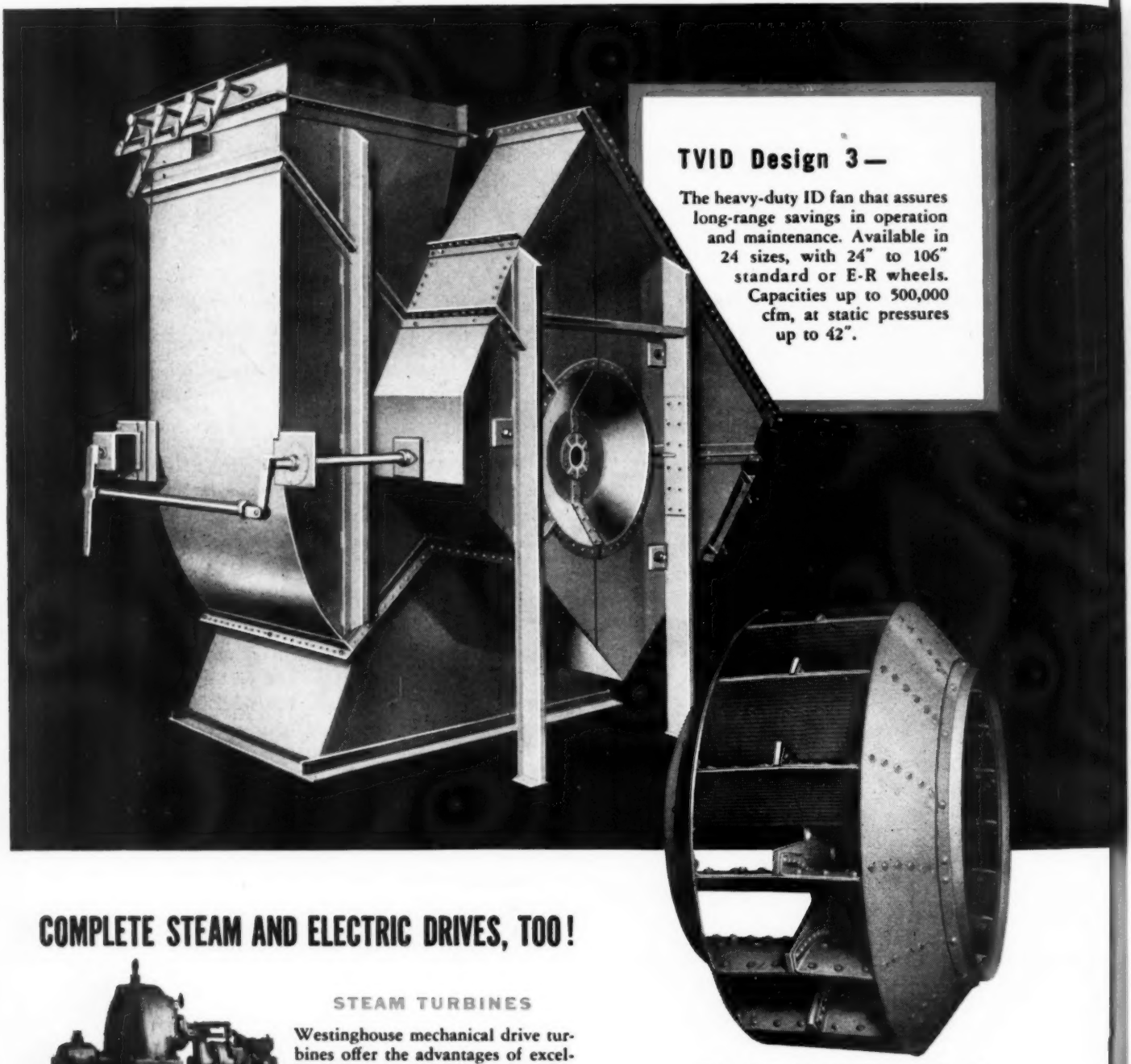
Supplied for either flush or projected mounting.



Any unit can be easily removed from the front without disturbing any other unit.

Each element is a complete, compact, sealed unit.

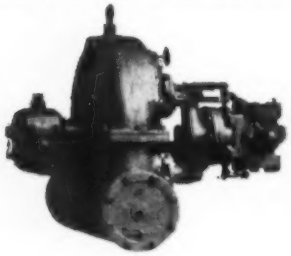
HIGHER EFFICIENCY—



TVID Design 3—

The heavy-duty ID fan that assures long-range savings in operation and maintenance. Available in 24 sizes, with 24" to 106" standard or E-R wheels. Capacities up to 500,000 cfm, at static pressures up to 42".

COMPLETE STEAM AND ELECTRIC DRIVES, TOO!



STEAM TURBINES

Westinghouse mechanical drive turbines offer the advantages of excellent efficiency and operating economy at speeds of 1000 to 4000 rpm. Available in wide range of sizes.

ELECTRIC MOTORS

Westinghouse motors, like this 400 H.P. CS Squirrel Cage unit, provide an ideal electric drive for induced-draft fans. Drip-proof construction assures long life and minimum maintenance.

Here's why the E-R wheel lasts 2 to 4 times longer!

Fly ash attacks itself, not the wheel—center plate cut out between blades, eliminating main focal point of erosion. Blades reinforced with renewable ribbed liners. One-piece side plates provide maximum strength to resist centrifugal stresses.

2 to 4 TIMES LONGER LIFE

with Sturtevant Design 3 TURBOVANE INDUCED-DRAFT FANS

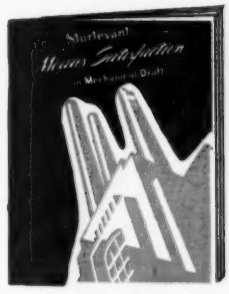
IN AN INDUCED-DRAFT FAN, *high efficiency* means low operating costs – *long life* means low maintenance expense. Combine these two, add the traditional Sturtevant *dependability*, and you've got the money-saving combination that's made the Design 3 TVID fan the big favorite with power plant operators all over the country.

Blade curvature, high-speed operation for direct drive, and skillfully designed inlet and outlet openings result in an all-time high in operating efficiency. And the time-proved erosion-resisting features of the famous Sturtevant E-R wheel make it stand up from 2 to 4 times longer under the destructive attack of concentrated fly ash.

Whatever your needs – induced-draft fans, forced-draft fans, primary-air fans, fly-ash collectors–remember that Sturtevant means satisfaction in mechanical draft. And the Sturtevant division of Westinghouse offers you complete "packaged" equipment–including the finest in steam or electric drives. Write to Westinghouse Electric Corporation, *Sturtevant Division*, Hyde Park, Boston 36, Mass.

WRITE FOR THIS NEW BULLETIN TODAY!

It contains 48 pages of valuable information on mechanical draft equipment, including the latest installation and operating data. It's just what you need as a reference text–profusely illustrated with photos, charts and diagrams. And it's yours for the asking–without obligation, of course. *Ask for Bulletin B-3801.*



ALL OF THESE BIG CENTRAL STATIONS

have placed repeat orders for TVID Fans and Wheels

Cleveland Electric Illuminating Co.
Louisville Gas & Electric Co.
Cincinnati Gas & Electric Co.
American Gas & Electric Service Corp.
Florida Power & Light Company
Alabama Power Company
Boston Edison Company
Consolidated Edison of N. Y.
Commonwealth Edison Company
West Penn Power Company
Georgia Power Company

Westinghouse
Sturtevant
DIVISION

ON 1,220,000

Keeps its bearings *in a "dust bowl"*

Ordinarily, we wouldn't recommend that you use an open motor on a job like this. This Tri-Clad motor drives a boiler-feed pump in the National Gypsum Company plant at Clarence Center, N. Y. The air surrounding the motor is constantly filled with gypsum dust which must be kept out of the bearings. And it *has* been kept out of the bearings of this Tri-Clad motor, thanks to its specially designed bearing housing and seals. We believe that the Tri-Clad motor you see here proves that even where dust, moisture, or some other hazard is extremely severe for open-motor applications, the extra protection afforded by Tri-Clad motor construction results in longer motor life and lower upkeep.

and now—THE TOUGHEST TRI-CLAD YET

Newest addition to the Tri-Clad motor family is the Tri-Clad totally enclosed, fan-cooled motor. It is designed for use in adverse atmospheres—in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. Available in both standard and explosion-proof types, this Tri-Clad motor gives you these important construction features:

- **A cast-iron, double-wall frame which completely encloses and protects the windings and punchings.**
- **A nonshrinking compound around motor leads which protects motor interior from dust and moisture.**
- **A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.**

MOTORS

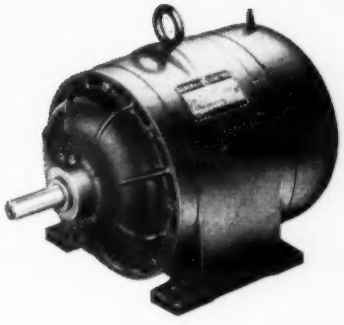
TRI/CLAD

THE SYMBOL OF

EXTRA PROTECTION

Announcement of the Tri-Clad motor, back in 1940, ushered in a new concept of general-purpose motor design. Substantially increased horsepower-per-frame-size, was one feature. Smarter appearance was another. But what really sold more than a million Tri-Clad motors is the *extra protection* we built into them.

Often operating under conditions no general-purpose motor should be asked to meet, Tri-Clad motors built up an enviable record of war-time service. Today, with the "family" including dripproof motors, vertical motors, gear-motors, capacitor-motors, and totally enclosed motors, the Tri-Clad motor is, more than ever, the motor that means basic protection, dependable performance, and minimum upkeep. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



EXTRA PROTECTION... AGAINST PHYSICAL DAMAGE!

Rigid cast-iron frame and end shields protect vital motor parts from external abuse and prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast-iron also gives you tight, *metal-to-metal* fits between end shields and frame.

EXTRA PROTECTION... AGAINST ELECTRICAL BREAKDOWN!

Motor windings of Formex* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly — motor stays young for years and years!

EXTRA PROTECTION... AGAINST OPERATING WEAR AND TEAR!

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

**Trade-mark reg. U. S. Pat. Off.*

GENERAL ELECTRIC

750—285

GE

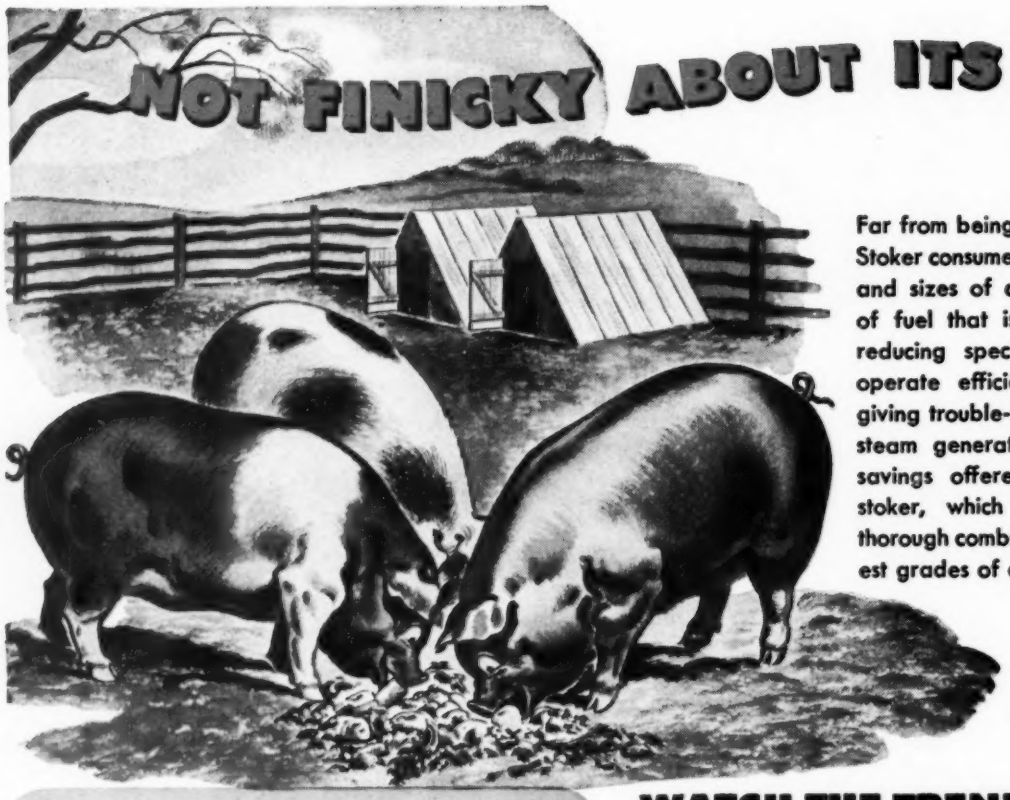
TRI/CLAD

REG. U.S. PAT. OFF.

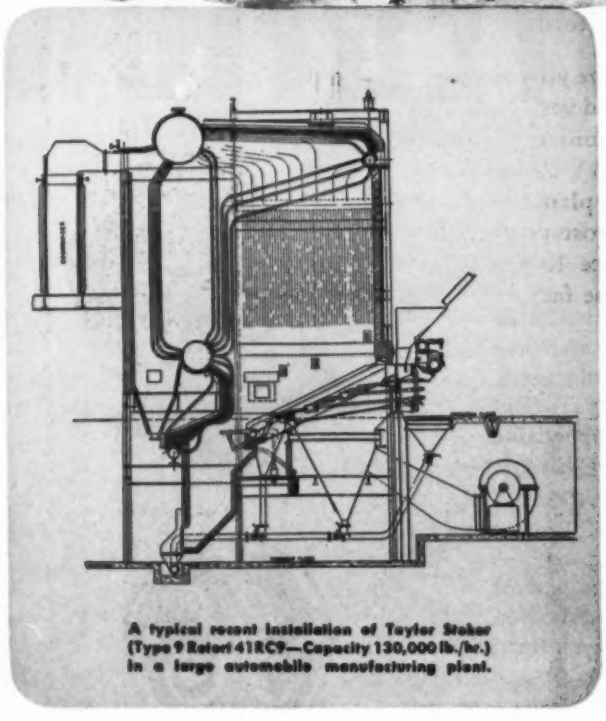
MOTORS

- OPEN (DRIPPROOF)
- TOTALLY ENCLOSED
- EXPLOSION-PROOF

NOT FINICKY ABOUT ITS FUEL!



Far from being "finicky," the Æ Taylor Stoker consumes a wide variety of types and sizes of coal. Feed it any grade of fuel that is suitable to your cost-reducing specifications, and watch it operate efficiently, economically . . . giving trouble-free service and low-cost steam generation. You'll welcome the savings offered by this fuel-flexible stoker, which assures you uniformly thorough combustion on even the cheapest grades of coal.



A typical recent installation of Taylor Stoker (Type 9 Retort 41RC9—Capacity 130,000 lb./hr.) in a large automobile manufacturing plant.

WATCH THE TREND!

Perhaps you already know of the preference for the Taylor Stoker—the stoker of *proved* performance. The Taylor Stoker has a record of highly efficient, reliable service in hundreds of boilers throughout the country.

Built upon engineering principles so sound that they have remained basically unchanged for over 35 years, the Taylor system of underfeed combustion has many modern improvements that make it *the* outstanding fuel-firing equipment for your power plant requirements. This stoker has simplified construction, continuous ash discharge and many other features that mean dependable. low-cost steam generation.

Don't take chances with untried, unproven stokers —specify Taylor and be safe. It's the leader!

UP-TO-DATE FACTS ON THIS IMPROVED TAYLOR STOKER

If you aren't up to the minute on Stokers, get your copy of this booklet. Write to Department 24 today!

TAYLOR STOKER

Æ

AMERICAN ENGINEERING COMPANY

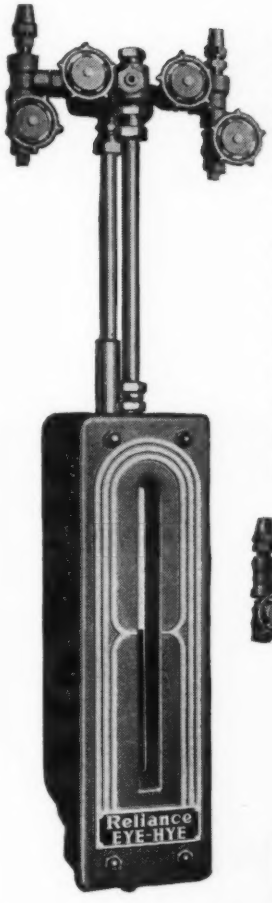
2400 ARAMINGO AVENUE, PHILADELPHIA 25, PA.

EYE-HYE

Use this one make of

Remote Reading Liquid Level Indicator

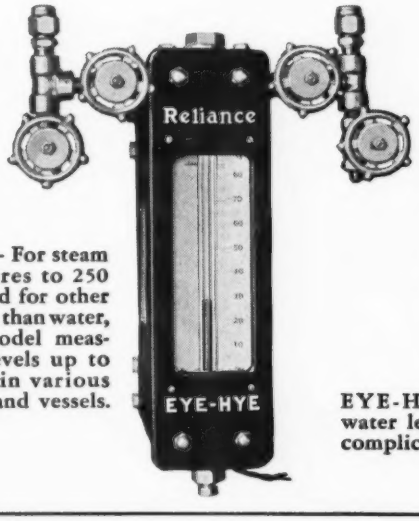
for safe, accurate, trouble-free service on all pressures—all water level measuring needs



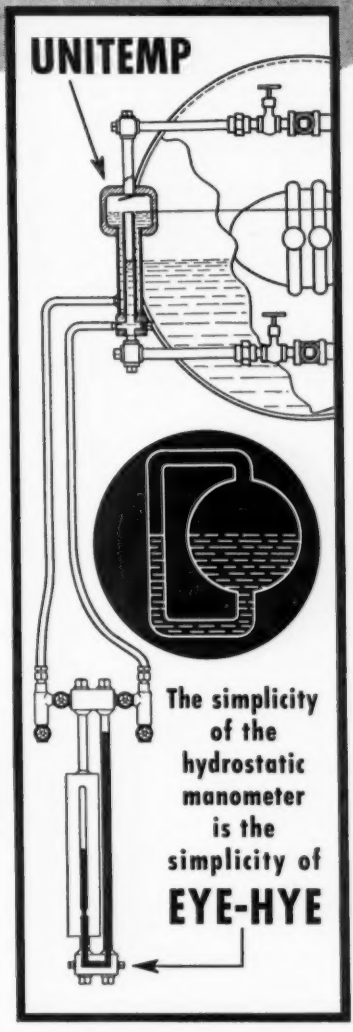
It pays you to standardize on RELIANCE EYE-HYE wherever you install remote reading gages. *And it pays you to install remote reading gages*—eye-level indicators that prevent operators from overlooking vital levels that need individual checking for safe efficient power plant operation, regardless of automatic controls.

EYE-HYE models are available to serve your main boilers, any pressure, and auxiliary tanks and vessels throughout power plant and factory. The familiar illuminated green liquid that characterizes EYE-HYE's quick accurate reading is known in thousands of plants. Well over 7000 of these accurate dependable hydrostatic gages have been placed in service. Ask a Reliance Representative for complete information—or write the factory.

Above—EYE-HYE for pressures to 2000 lbs. Models for panel or wall mounting. *Right*—Model for pressures to 400 lbs; also furnished for either panel or wall mounting. An adaptation of this model carries face plate scaled in gallons, proportions, etc.



Right—For steam pressures to 250 lbs., and for other liquids than water, this model measures levels up to 12 ft. in various tanks and vessels.

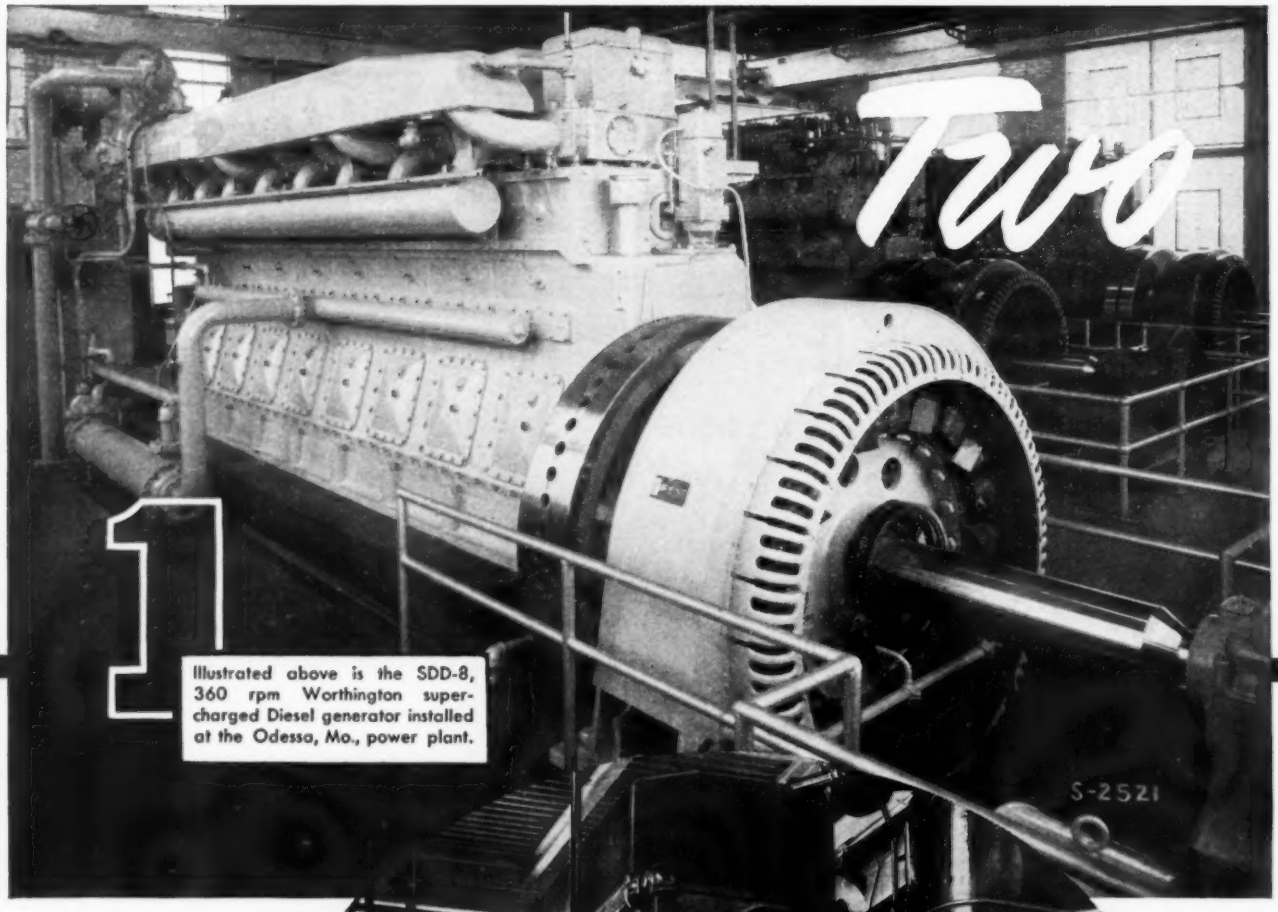


EYE-HYE gives you clear, unmistakable water level indication. Easy to install; no complicated mechanisms to adjust or get out of order.

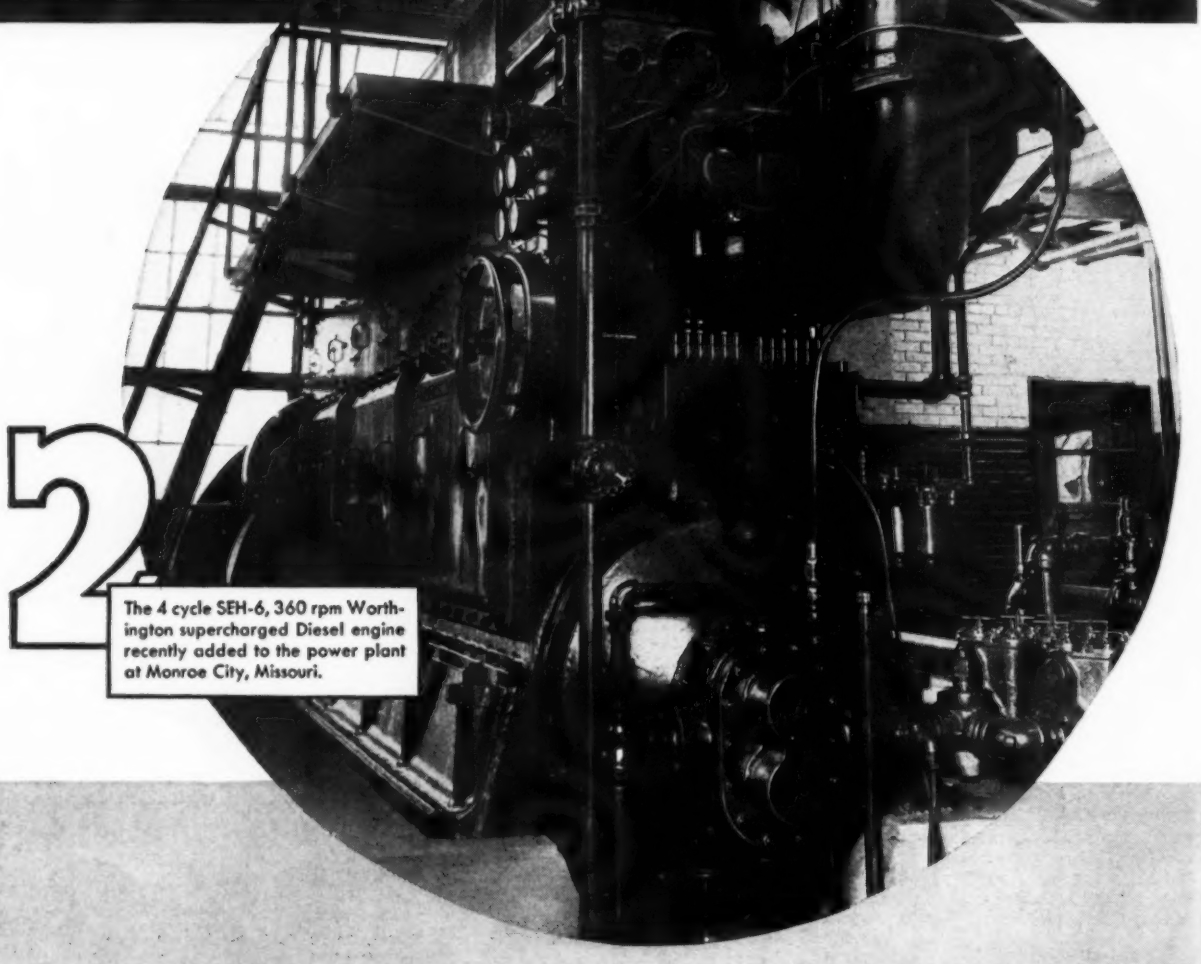
BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO



Illustrated above is the SDD-8, 360 rpm Worthington supercharged Diesel generator installed at the Odessa, Mo., power plant.



The 4 cycle SEH-6, 360 rpm Worthington supercharged Diesel engine recently added to the power plant at Monroe City, Missouri.

Power Plants

PREPARED FOR TOMORROW'S GROWTH

Operating with Economy Today

In Missouri the municipalities of Monroe City and Odessa design their generating plants for *future* power demands by installing Worthington supercharged Diesel engines, today.

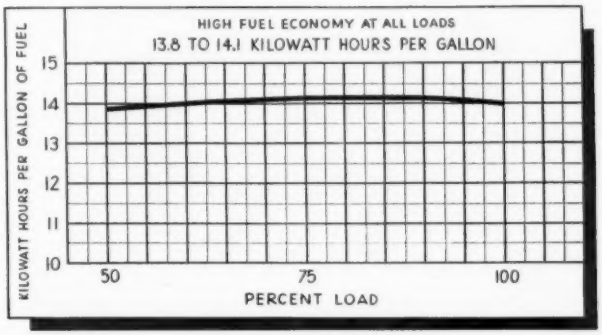
And the new Diesels . . . installed in both plants in 1946 . . . supplement other Worthington Diesels placed in Monroe City since 1935, and in Odessa since 1939.

For the investigated facts proved to these two communities that the low fuel demands of the Worthington supercharged Diesels were economically sound, even when operated at fractional capacity.

Yet, future increases in power demands are adequately provided for at the same low fuel consumptions (see chart), making the future use of these Worthington Diesels continually profitable.

So if your community seeks power that is highly economical today . . . greatly profitable in the future . . . designed for long life and easy maintenance . . . then investigate Worthington supercharged Diesel engines.

Write for more information and prove to yourself that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*



This chart illustrates the Worthington Diesel's low fuel costs . . . and the very slight rise in fuel demands when changed from fractional to full power loads.

WORTHINGTON

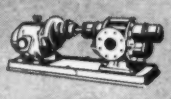
E7-6

YOUR PARTNER IN POWER PROGRESS

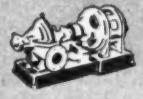
Diesel engines, 150 to 3,520 hp . . . gas engines, 175 to 3,290 hp . . . dual fuel Diesel engines, 225 to 3,290 hp.

WORTHINGTON-BUILT AUXILIARIES

Air King Compressors



Oil Transfer Pumps



Cooling Water Circulating Pumps

Evaporative Type Engine Water Cooler

C-E has no axe to grind

A complete line removes any bias in favor of a particular type. C-E offers you the most complete line of stokers available today . . . a line that meets every requirement of fuel, capacity and load conditions in commercial heating, industrial and power generation fields. This freedom of choice, *offered you by C-E alone,* has substantial advantages. Among the most important of these is the assurance of obtaining the equipment best suited to your specific requirements, as determined by experienced, *impartial* investigation.

Each of the basic types here illustrated is the result of fifty years of experience in stoker design and application . . . and, more than that, each type reflects the practical knowledge of fuels and operating conditions C-E has acquired in installing more than 19,000 stokers.

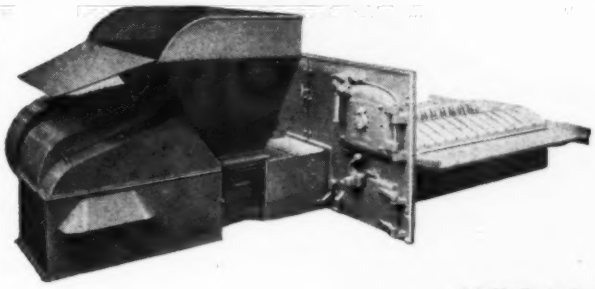
Since the cost of fuel burned on a stoker in a single year greatly exceeds the initial cost of the stoker itself, it is evident that the performance a stoker will give is a far more important consideration than the purchase price. Top performance will continue to pay dividends on your stoker investment long after the purchase price is forgotten.

You can assure yourself of top performance by coming to C-E — *stoker headquarters* — for assistance when you are in the market for stokers. You will gain materially by using the service of a manufacturer who has no axe to grind! B 120

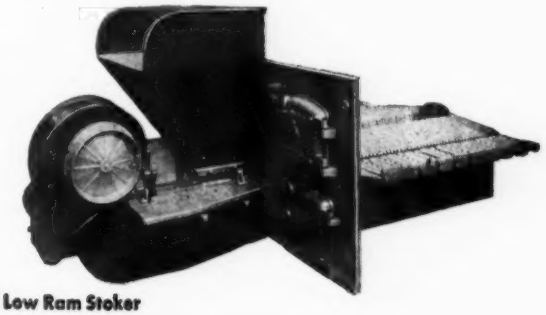
C-E

COMBUSTION

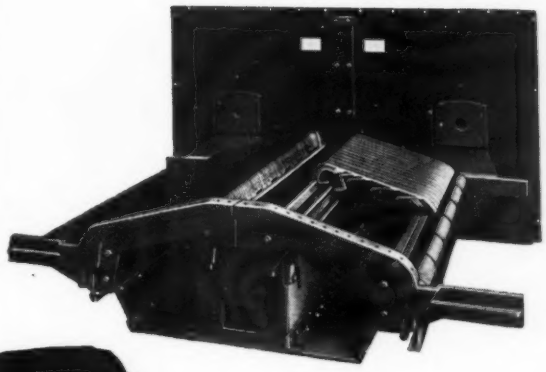
C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS



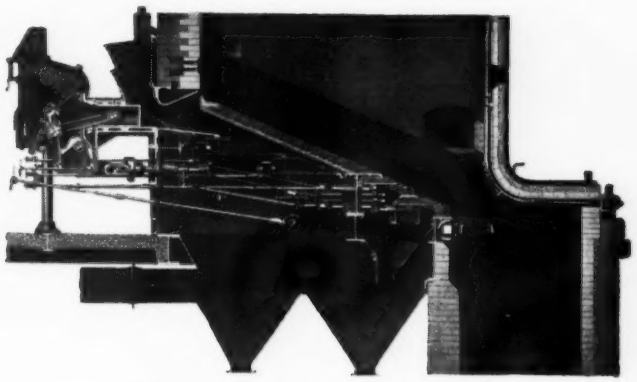
C-E Skelly Stoker



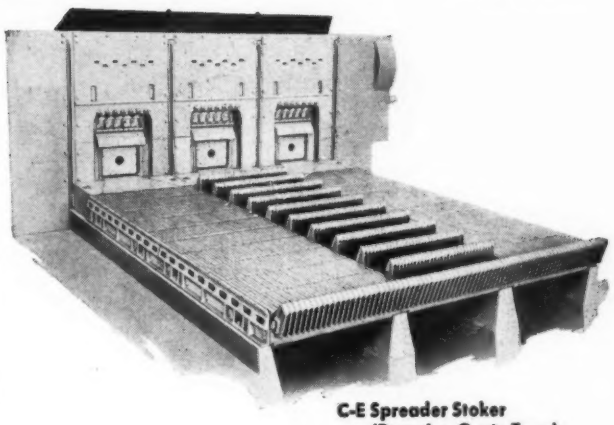
C-E Low Ram Stoker



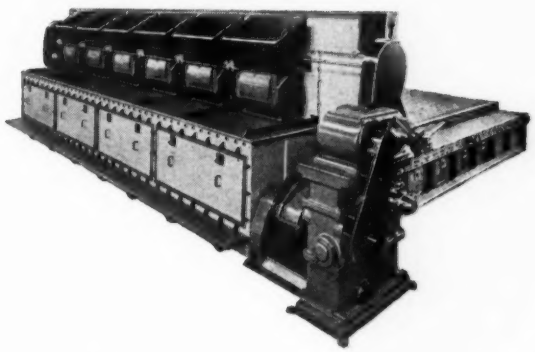
C-E Type E Stoker



C-E Multiple Retort Stoker

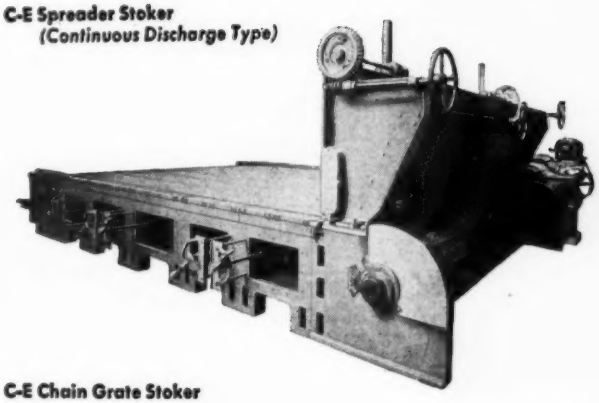


C-E Spreader Stoker
(Dumping Grate Type)



C-E Spreader Stoker
(Continuous Discharge Type)

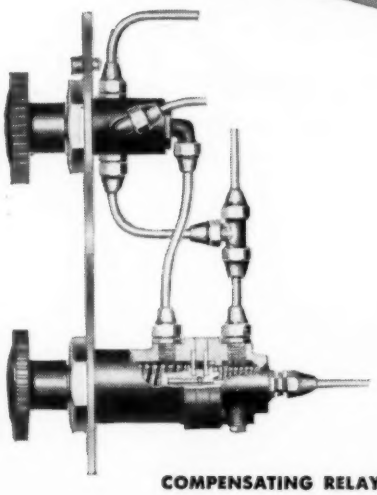
C-E Traveling Grate Stoker



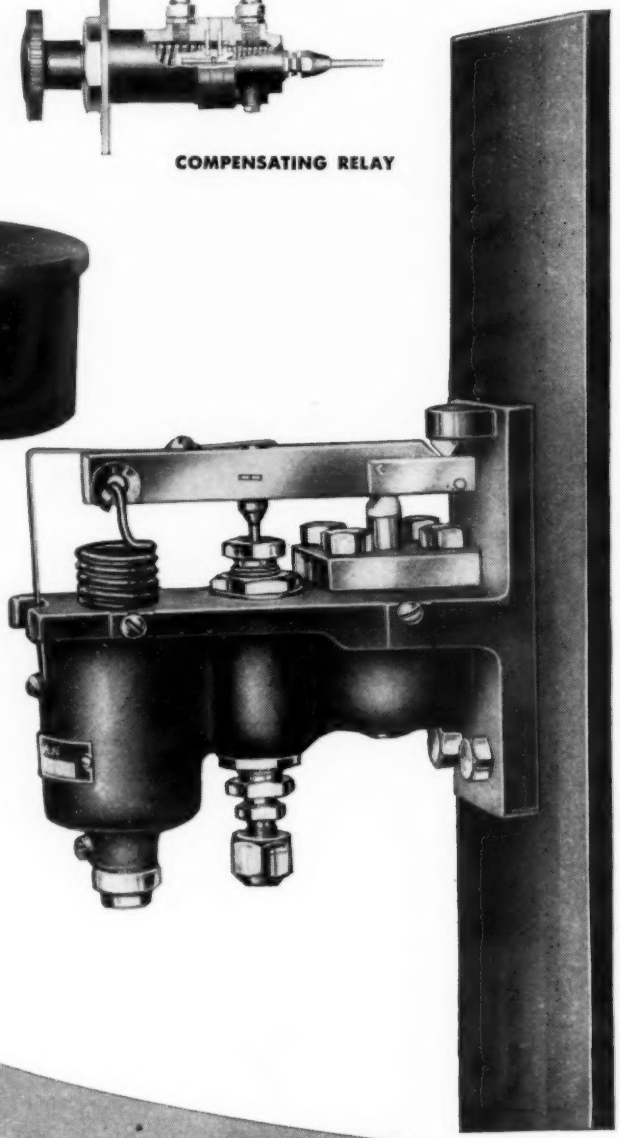
C-E Chain Grate Stoker

ENGINEERING
200 MADISON AVENUE, NEW YORK 16, N. Y.

BALANCED FLOAT REGULATOR



COMPENSATING RELAY

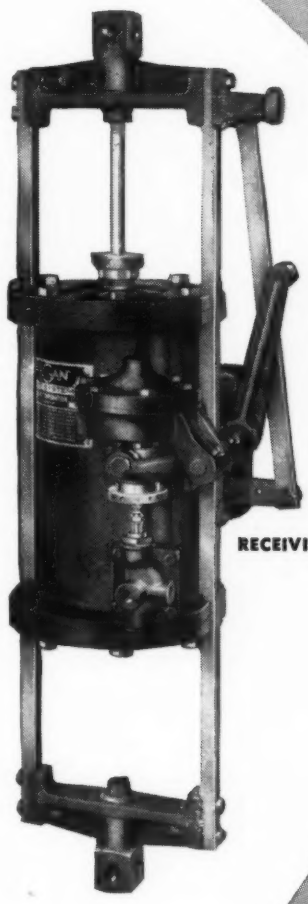


TYPE "FL" MASTER SENDER

HAGAN
HALL
BUROMIN
CALGON

Fuel Economy

FOR SMALLER PLANTS



RECEIVING REGULATOR

Fuel economy has made automatic combustion control standard equipment in virtually every large power plant.

Fuel economy through automatic combustion control is just as important in small plants. Control systems in these plants need not be as elaborate as in larger plants, but they must meet large-plant standards of quality and performance, and their cost must not be out of proportion to the savings they produce.

The Hagan simplified automatic control system meets the needs of these plants. For some plants this may consist essentially of only the Hagan Master Regulator and one or more Hagan Balanced Float Regulators. Others may require the Hagan Unit Control System, with the Hagan Master Sender supplying a loading for relays and power units regulating air and fuel input, and with the Hagan Type D Regulator and Receiving Regulator maintaining constant furnace draft.

In either case, the result is a rugged, efficient system that *pays for itself* in lower fuel costs.

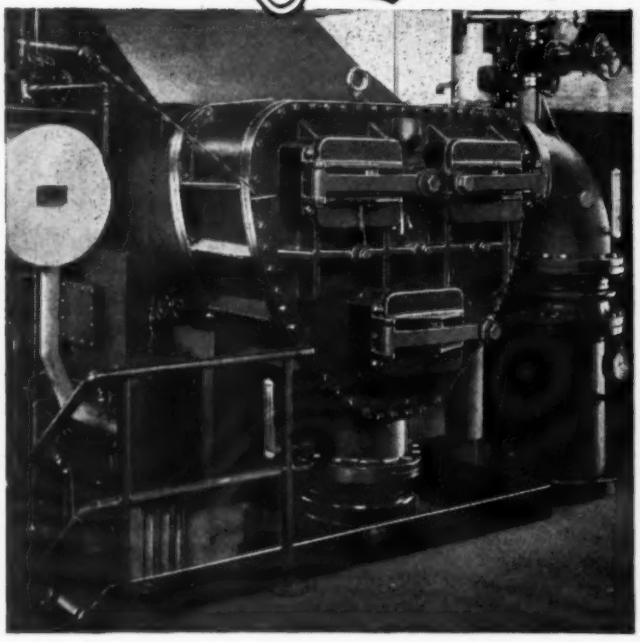
Our engineers will be glad to show you how a *simplified* Hagan system will meet the needs of your plant. Write for full information.

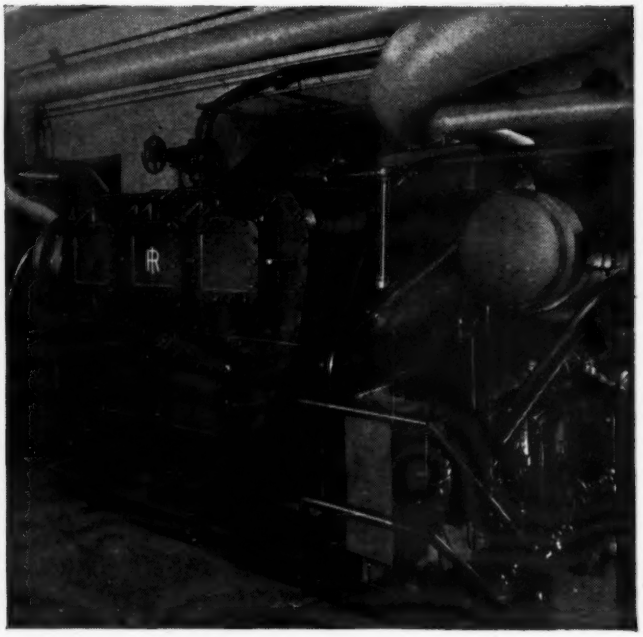
Hagan Corporation, Hagan Bldg., Pittsburgh 30, Pa.

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.
4-956





Two of the four Ingersoll-Rand Class H condensers in the Woodcock plant. The one at the left serves a 5000 kw turbine generator and the one at the right a 7500 kw unit.

Central Ohio Utility to Install 4th Ingersoll-Rand Condenser

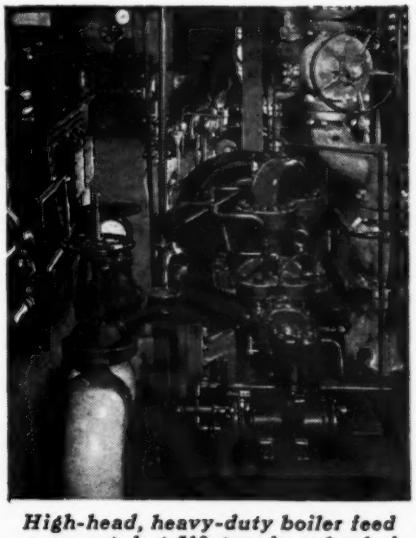
The past ten years have been a period of steady growth for the Woodcock station of the Central Ohio Light and Power Co. This plant is typical of the many smaller central stations throughout the country in that it serves a fast growing farm and industrial area. When the Woodcock station was built in 1937 by Sargent & Lundy, Inc., it housed a 5000 kw turbine generator plant served by an Ingersoll-Rand condenser.

Since 1937 two more generators have been added to the Woodcock station and each time Ingersoll-Rand condensing plants were chosen to serve them. In 1939 the second 5000 kw generator was added, and then in 1942 the sharp increase in power consumption created by the war called for more capacity and a 7500 kw unit was installed. Now in 1947 a 10,000 kw generator and the 4th Ingersoll-Rand condensing plant will be put into service to meet the growing power needs of an expanded peacetime economy.

In addition to the I-R condensers, condensate pumps and air removal equipment there are four high-head heavy-duty I-R Cameron boiler-feed pumps and an Ingersoll-Rand compressor serving the Woodcock station.

Consistent, far-sighted planning has enabled the Woodcock station to meet a steadily growing demand for power. In each case the selection of Ingersoll-Rand condensing plants has given the Woodcock station the benefit of the latest developments in condenser design. Aided by a continuous development program and exceptional facilities for accurate testing and full scale experimental work, Ingersoll-Rand has consistently made important advances in condensing plant design that have benefited the entire power industry.

If you are planning an expansion of your present power generating facilities be sure and call in an Ingersoll-Rand specialist. He can show you new developments in condenser design that will save space and cut construction costs in your next steam power plant.



High-head, heavy-duty boiler feed pump rated at 512 gpm for a head of 1390 ft.

SILICONE-TREATED

★ *at temperatures up to 200 C*

Silicone varnishes now give extra heat protection to every layer of insulation on a complete, new line of Deltabeston* wires and cables. Built to cut out heat problems in 600-volt service, these cables are ready to go to work at continuous temperatures up to 200 C (392 F).

A silicone-treated asbestos layer fights CONDUCTOR HEAT. A silicone-treated glass tape adds dielectric strength and resistance to MOISTURE. Another silicone-treated asbestos layer gives protection against AMBIENT HEAT. And an over-all abrasion-resistant glass braid is silicone-treated to take plenty of ROUGH HANDLING.

For 300-volt service, another complete line of silicone-treated Deltabeston cables is available to cut heat problems at temperatures of 200 C. Both 300- and 600-volt constructions are approved for use in the wiring of ovens or other high-temperature equipment, such as furnaces and control apparatus, where the acceptability of the wire for the particular use has been determined by the Underwriters' Laboratories, Inc.

For information or assistance in planning for the new silicone-treated Deltabeston cables, write to Section Y84-863, General Electric Company, Bridgeport 2, Connecticut.

**Trade-mark Reg. U.S. Pat. Off.*

GENERAL ELECTRIC

HI-AMBIENTS

Application Hints from Your Deltabeston Distributor

Taking abuse is an old story to Deltabeston power cables. They're laboratory-tested by all kinds of fiendish devices to make sure they'll stand up on the job. But it's not the laboratory alone that gives Deltabeston power cables their good name. It's on-the-job performance that shows they're right for fighting the effects of heat, flame, moisture, grease, and oil. Look at what Deltabeston has to offer before you wire your next hot spot.

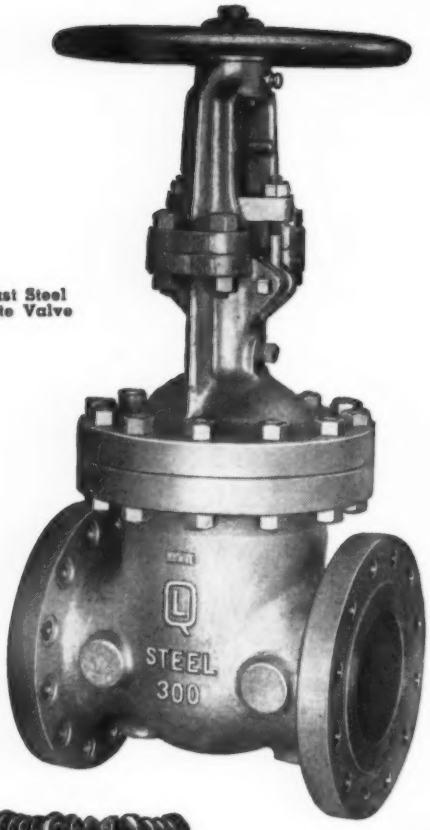
Motor windings that can't take heat are always trouble-makers. But you can get around this kind of trouble with Deltabeston asbestos or glass insulated magnet wire. The most intricate coils can be formed with Deltabeston because its copper is soft and extremely flexible. It's available in round, square and rectangular shapes in sizes to fit all needs. If you do your own motor winding, use Deltabeston magnet wire. If you send your jobs to an outside shop, be sure to specify it.

Whenever you need help on wiring to beat the heat, look up your General Electric Merchandise Distributor. He's always ready to give you advice, and he can help you choose the right materials for the job.

DELTABESTON
Wires and Cables
Built to beat the heat

From selection of Raw Materials

Cast Steel Gate Valve

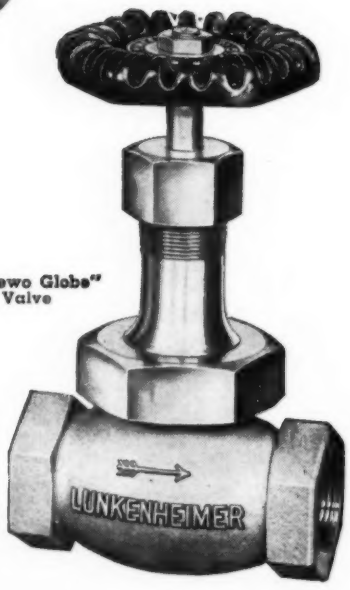


Iron Body Gate Valve

...to

"King Clip" Gate Valve

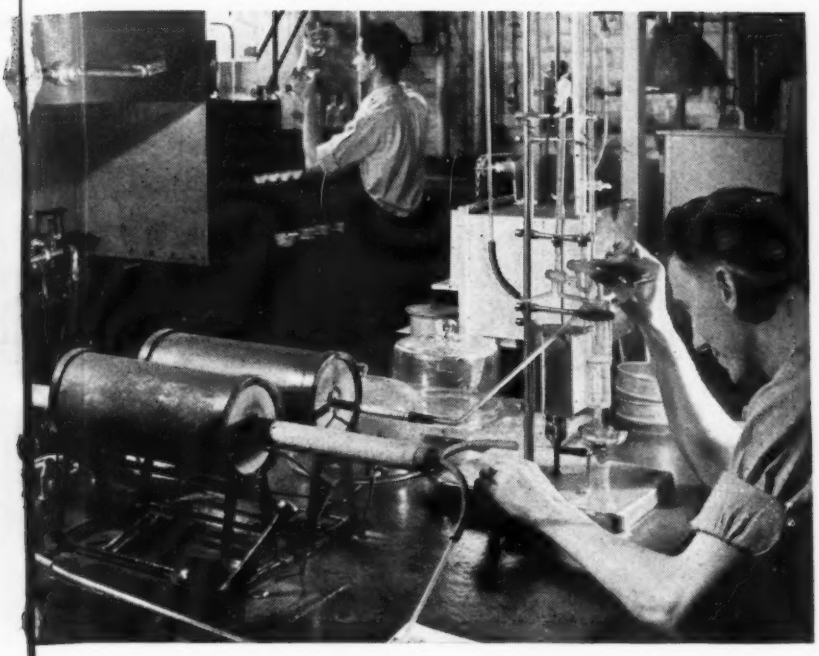
"Renewo Globe" Valve

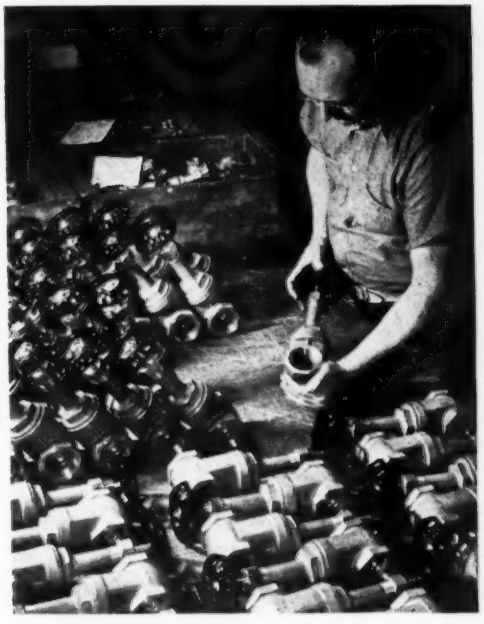


CALL YOUR LUNKENHEIMER DISTRIBUTOR!

You'll find him fully equipped and ready at all times to assist you in solving problems of valve maintenance and operation. The functions he performs are highly important in the Lunkenheimer set-up, designed to give you better, more efficient, more reliable valve service. Lunkenheimer Distributors are located in principal industrial centers. There's one near you with complete facilities.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS





Final Assembly

RELIABLE SERVICE, LONG LIFE, LOW MAINTENANCE COST ARE BUILT INTO LUNKENHEIMER VALVES

Selection of the finest raw materials . . . careful testing of each lot of molten metal before it is drawn from furnace or cupola . . . perfect castings made in modern foundries . . . accurate grinding and finishing by skilled mechanics operating the most advanced modern machinery . . . final assembly and checking to rigid standards . . . *these* are factors that build *quality* into every Lunkenheimer Valve—quality which assures that outstanding performance, longer service life, and minimum upkeep familiar to maintenance men everywhere.

Through more than 85 years of constant research, Lunkenheimer has originated one important valve design and improvement after another . . . many significant "firsts" . . . all contributing to even finer Lunkenheimer Valves . . . even more service and value for their users.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

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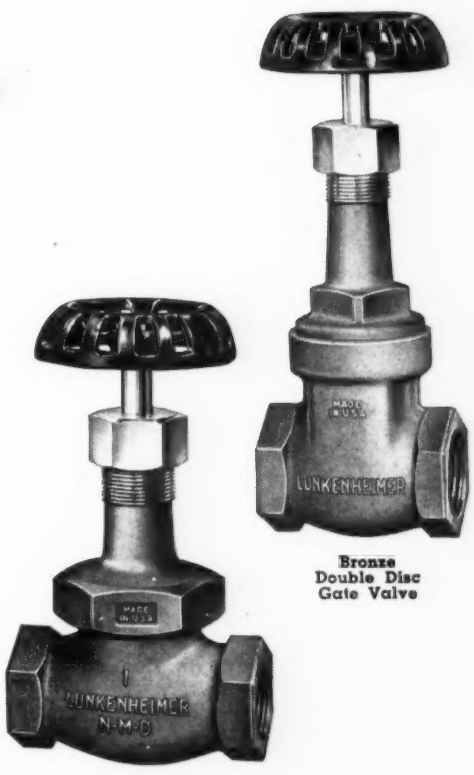
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.



Bronze Double Disc Gate Valve

"N-M-D" Globe Valve

LUNKENHEIMER VALVES

Sheave to Transmit 1400 Horsepower...

...or a Belt for a 1/4 hp Compressor!

CALL ON THE TEXROPE LINE for the *best* in V-belt engineering and V-belt equipment. That has been true for 22 years — ever since Allis-Chalmers originated the Multiple V-belt drive for industry.

Back of every *Texrope* installation — from fractional horse power V-belts that manufacturers put on washers, air-compressors or water systems—to the biggest V-belt drives ever designed and successfully applied—stands the finest V-belt engineering talent in the world.

There's no substitute for this vast experience and tremendous fund of knowledge. It is reflected in every *Texrope* product.

What do *you* need... a few V-belts and sheaves — or a daring new application of the multiple V-belt principle? Call on the *Texrope* line! Equipment and engineering help are as close as your nearest A-C sales office or dealer. ALLIS-CHALMERS, MILWAUKEE.

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TEXROPE ..Greatest Name in V-Belt Drives

"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.

SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

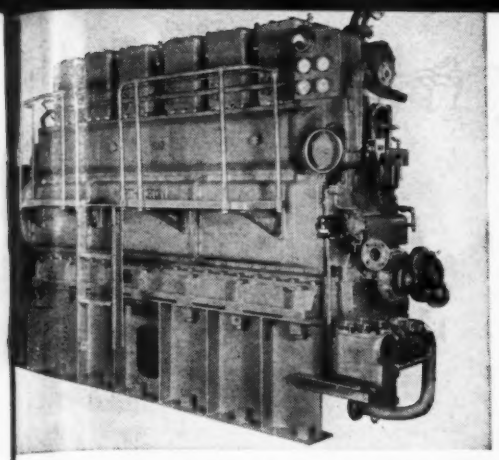
ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947
A CENTURY OF SERVICE to Industry THAT MADE America Great



Model SDH-6 Worthington four-cycle Diesel engine operating at 600 rpm with a 580-kw E-M Generator.

Mountain Top Site Dictates Choice of Worthington Diesel

The only place in the United States where abrasive garnet is mined is at the top of Gore Mountain in the Adirondacks. Garnet is an extremely hard, tough, crystal mineral used on sandpaper, in grinding wheels, in loose grain form, and in powder form as optical abrasives and abrasive compounds.

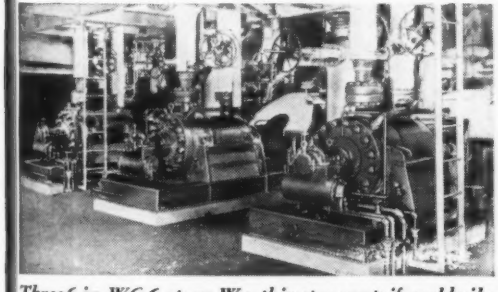
Barton Mines Corporation, the sole producer of abrasive garnet, is engaged in a program of modernizing its power facilities and is building a new full Diesel generating plant around a unit supplied by Worthington.

The new engine is a Worthington turbo-charged SDH—a heavy-duty, four-cycle Diesel, capable of producing maximum power with high, sustained economy at all loads—even at the altitude of this power plant.

Pressure-Charged Intake

Turbo pressure-charging of a modern, four-cycle Diesel is accomplished by a single stage turbine driven by heat and energy pulsations in the engine exhaust gas, usually wasted in the exhaust silencer. This exhaust gas turbine is directly coupled to a centrifugal blower which compresses the air to a pressure of 4 or 5 lbs. Pressured air is then delivered to the individual cylinders through the conventional intake air manifold.

The fuel consumption of a turbo-charged Diesel engine is lower than comparable sizes of atmospheric-charged units. Clearing the exhaust gases from the cylinder and replacing them with clean, cool, pressured air assures more efficient combustion. The turbo-charged engine develops approximately 50% greater hp without materially increasing the internal friction load of the engine. At partial load, fuel consumption will be lower, because the unit delivers pressured air in proportion to the engine load. The fuel consumption curve is practically flat from 50% load through full load.



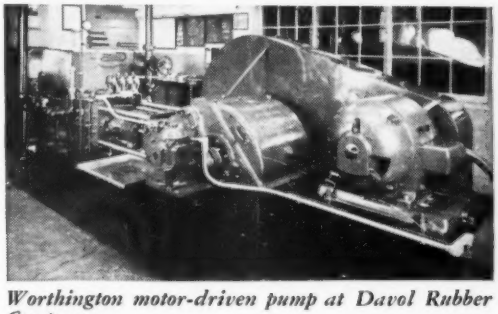
Three 6 in. WC 6-stage Worthington centrifugal boiler feed pumps at Essex Station of the Public Service Electric and Gas Company, New Jersey.

50,000 Operating Hours with Original Rotors

No wonder Public Service Electric & Gas Co. of New Jersey is installing three Worthington WCS 7-stage solid case boiler feed pumps for the 100,000 kw unit being installed in its Essex Generating Station.

In the present station, three 6 in. WCS 6-stage centrifugal boiler pumps have operated a total of nearly 150,000 pump hours in 70,000 hours of elapsed time (load is alternated at regular intervals). Two of the pumps each show 50,000 operating hours with the original rotors; the third has had a single rotor change.

Inasmuch as 30,000 operating hours is considered excellent, this performance—accomplished during a period of wartime overloads—is outstanding.



Worthington motor-driven pump at Davol Rubber Company.

"Practically Eliminating All Rejection," Reports Fine Rubber Goods Manufacturer

Greatly increased productive capacity and practical elimination of all rejections are the results reported by Davol Rubber Company, Providence, on the performance of their new Worthington 2000 psi hydraulic system.

This complete Worthington hydraulic system consists of a 2 x 10 KMF motor-driven pump with automatic suction valve unloaders, air bottle type accumulator, control panel with recording instrument, automatic safety shut-off valve, and charging air compressor.

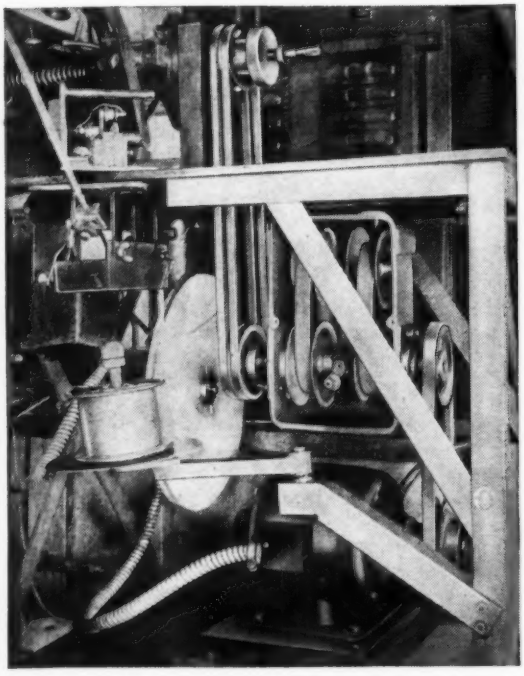
A recent report states that the accumulator does not lose so much as one pound of pressure during the weekend shut down and that no air has been added to the system for a period of three weeks.

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

NEWS from the power front



Model A Allspeed Selector used by Breeze Corp. on machine manufacturing flexible metal tubing. Expansible sheaves give speed variation.

Production Doubled Actually! By Varying Drive Speed

At the Breeze Corporation, Newark, N. J., Worthington's Allspeed Selector accomplished a 100% increase in production by making it easily possible to start machines at lowest speed and then increase, with stepless graduation, to a top speed giving maximum machine and operator production.

On machines manufacturing flexible metal tubing, it is desirable to have a slow set-up speed of two feet of tubing per minute, and a gradual increase to a possible peak of 32 fpm. Ideal production speed is from 4 to 18 fpm on small diameters, 6 to 8 fpm on larger sizes.

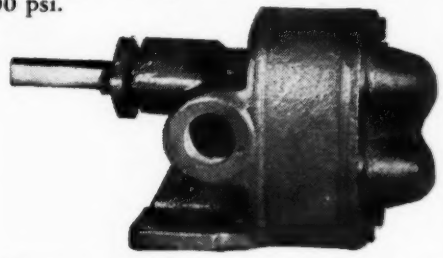
When driving from overhead belts, it was necessary to run the machines at the slow set-up speed, giving a maximum constant production speed of 3 fpm. Introduction of variable speed motors increased production speed by about 50%, but did not provide the desired flexibility in speed due to the fact that only four speeds were permitted. Moreover, it was necessary to stop the machines in order to shift speeds. Since changes in specification occur frequently, this meant a considerable loss in production.

Worthington's Model A Allspeed Selector provides the flexibility essential to top production, and eliminates the shutdowns for speed changes. And because speed is adjusted to the requirements of the material, there is also an improvement in quality.

New Line of Rotary Pumps

GA ROTARY PUMP

A new line of general service rotary pumps, the GA Rotary type, has been introduced by Worthington. Six sizes are available in various mountings for capacities up to 51 gpm and 100 psi.



These small capacity rotary pumps have been designed for durability under severest service requirements, and adaptability to variety of such requirements offered by industries. Design features include four bearing construction and special herringbone rotors. Built-in pressure lubrication eliminates all external lubrication and the danger, prevalent in many industries, of liquid contamination. A production line item, the GA Rotary in its simplicity of design also offers easy maintenance and low first cost.

Models are available foot mounted or flange mounted with adjustable stuffing box and mechanical seal. They are also available with or without oversize unloader type relief valve. All models are suitable for direct coupling to electric motors of any make.

The pumps that serve the air conditioning system here are driven by Worthington-Moore Steam Turbines.

Low Pressure Turbines Power Capitol Air Conditioning

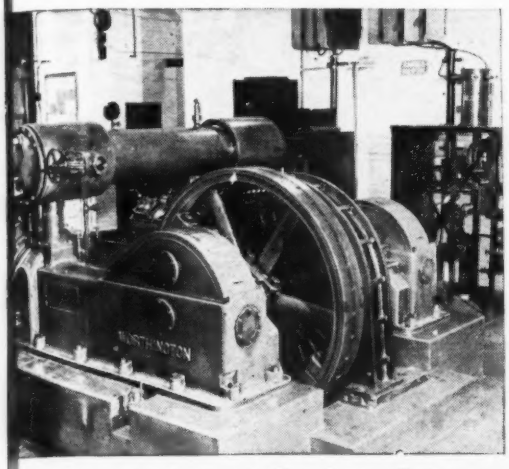
In the power plant connected with the United States Capitol and surrounding buildings Worthington-Moore steam turbines are used to drive the chilled water and condenser water pumps serving the air conditioning system.

Each of the two chilled water pump turbines is rated at 800 hp, and is equipped with separate reduction gears. The turbines operate at 4500 rpm, and the gears reduce the speed to 1450 rpm.

The condenser water pump turbines are rated at 511 hp. They operate at 4500 rpm, and gears reduce the speed to 800 rpm.

In both cases, the turbines operate on steam at 40 lb. pressure and exhaust into a vacuum of 26 in.

All four turbines were installed in 1937, and they are used approximately 6 months a year, an average of 16 hours per day.



Worthington Compressor supplies air at 90 lb. pressure.

Pneumatic Equipment Thrives on Night Air

A Worthington 12 in. stroke DC2 Air Compressor installed in a New Jersey plant has been working on the night shift, delivering 1280 cfm to paint sprays, pneumatic cylinders and pneumatic shakers in the foundry, since 1939.

During a seven-year period of severe and continuous service, running from five in the evening to seven in the morning, much of the time at 100% capacity and averaging 75% for the entire shift, frequently doing emergency 24-hour service for several weeks on end, this compressor had not had a single instance of unplanned downtime.

It is run on an average of 1200 hours between changes of crankcase oil. During yearly overhaul and inspection, only minor replacements and adjustments (considered part of preventive maintenance) have been required. In 1945, the main bearings were taken down for the first time and showed very little wear; also true of the high pressure crank bearings.

New Worthington QD Sheave Lines

Two new lines of QD sheaves, featuring improved groove-belt fit and reinforced arm construction, have been announced by Worthington. Designated as the A and B lines, each will feature individual groove size to match belt size—thus an A groove for an A belt, a B groove for a B belt. Former A-B combinations have been discontinued.

Reinforced "I" beam arm construction of new Worthington QD Sheave.

Like the "I" beam construction of a bridge girder, the reinforced arm construction of the new Worthington QD drive sheave incorporates a longitudinally ribbed arm recessed down the middle. Advantage of this type of arm is that material is removed at or near the neutral axis where it adds little or no strength to the arm. This material is then added at the points most remote from the neutral axis, where it gives the greatest strength.

Packaged Power Plant Bound for Eti Bauk

Power for the Soma Lignite Coal Mines at Eti Bauk, Turkey, will soon be coming from a Worthington Loftus-Designed Steam Power Plant, consisting of two 1000-kw units.

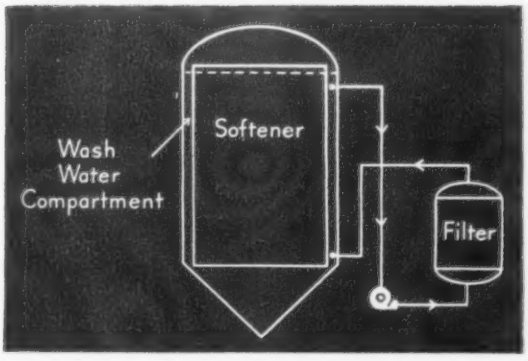
This power plant is a complete electrical generating station having features of portability, compactness, simplicity of design and operation, ease of assembly and disassembly, and adaptability to a wide range of climatic conditions and variations of fuel and water supply.

It is made up of the necessary items of power generation equipment arranged in relatively large, pre-assembled units which can be electrically and mechanically interconnected with the minimum of field erection time and labor.

Worthington Hot Process Water Softener Design Eliminates Filter Backwash Troubles

Dozens of installations have proved that the usual filter difficulties are eliminated in the exclusive Worthington design which divorces the filter backwashing process from the softening process. An accumulator wash water storage and settling compartment provides clear, hot, deposit-free water for backwashing purposes thereby indefinitely prolonging the life of the filter, increasing the period between backwashing operations and decreasing the time of the operation. The filter is washed clean with clean water without disturbing the softening process.

7-1



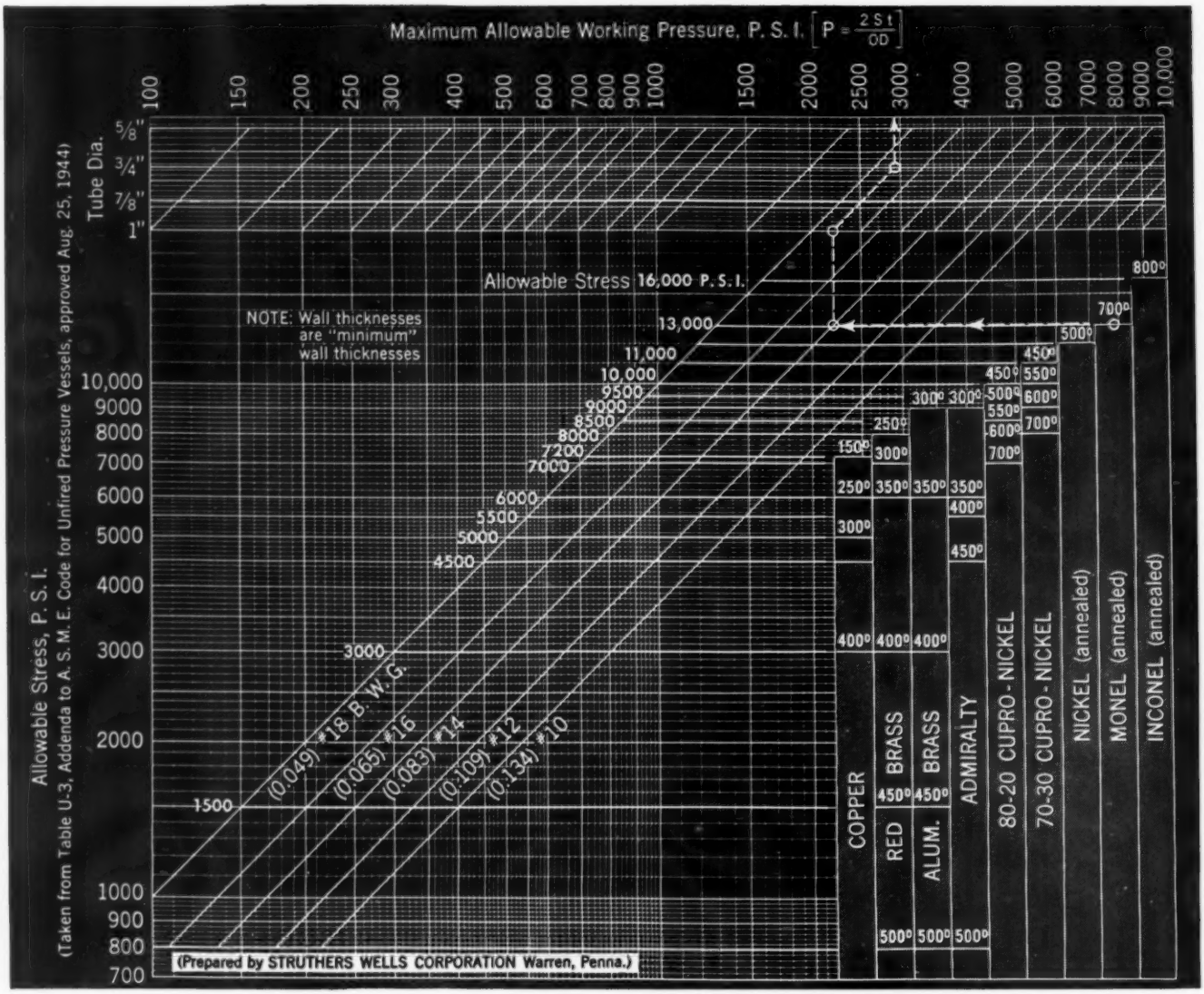
Worthington Pump and Machinery Corporation

•

Harrison, N. J.

How to select PRESSURE TUBING

This chart quickly gives you the MAXIMUM ALLOWABLE WORKING PRESSURES under the A.S.M.E. Unfired Pressure Vessel Code for given wall thicknesses and outside diameters of typical non-ferrous tubing in U-tube constructions



HOW TO USE CHART

Sample problem: Find the maximum allowable working pressure for ¾" O.D. Monel* tubing with a wall thickness of 0.083" (#14 B.W.G.).

1. Enter the grey column labeled MONEL. Go to its top, at the 13,000 P.S.I. Allowable Stress level.
2. Move left along the 13,000 P.S.I. level until it intersects the diagonal labeled (0.083) #14 B.W.G.
3. From this point of intersection, move vertically up to the horizontal line marked 1" Tube Dia.
4. From this new point of intersection, move diagonally to the upper right, keeping parallel to the diagonal lines, until you reach the horizontal line marked ¾" Tube Dia.
5. Vertically above this final point of intersection, is the maximum allowable working pressure — approximately 2,880 P.S.I.

PRESSURE TUBING of Monel, Nickel or Inconel* offers outstanding usefulness wherever high pressures and temperatures are involved. For example, these strong, thermally-durable alloys are ideal for U-tube high-pressure feedwater preheaters. *Reg. U. S. Pat. Off.

Reprints of this Time-Saving Chart are available upon request.

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G.T.M.-Specified

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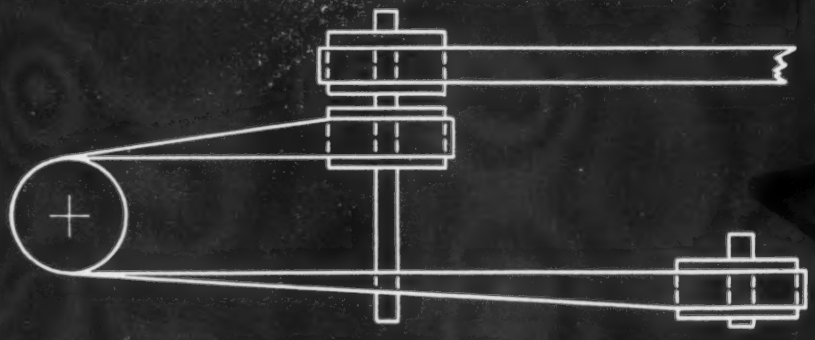
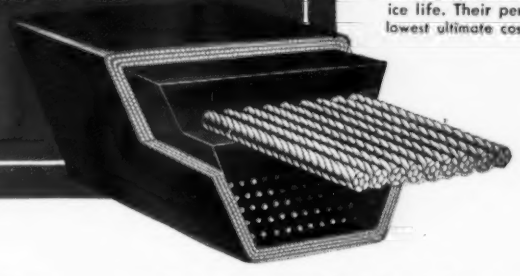


MILL-PROVED MONEY SAVERS



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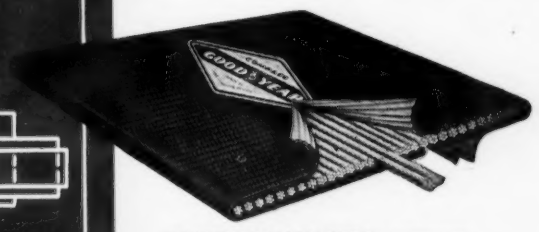

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E-C CORD MULTI-V-BELTS are uniform in length, cross section, pull and service life. Their perfect teamwork insures lowest ultimate cost.

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And more — you get the expert counsel of the G.T.M. — Goodyear Technical Man. His on-the-spot specification gives you these superior products in the exact size and construction your problem requires. For more detailed information, why not consult the G.T.M.? Write: Goodyear, Akron 16, Ohio or Los Angeles 54, California.

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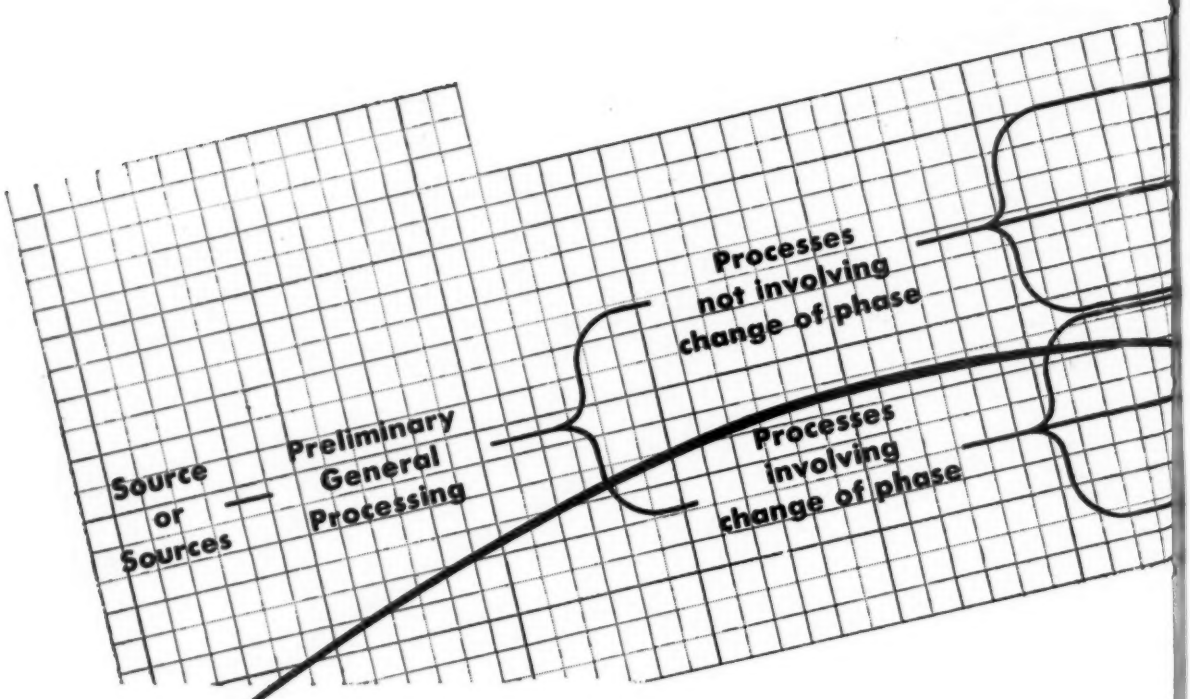
Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

Pre-treatment

The objectives of boiler water conditioning are (1) to eliminate or minimize the formation of scale; (2) to inhibit corrosion and embrittlement and (3) to prevent carry-over. The problem is to set up procedures which, in a specific situation, will best achieve these objectives at minimum investment and with lowest operating cost.

Always, treatment of water within the boiler will be required, but in most instances a part of the water conditioning is most economically done before the water enters the boiler.

But—in a given case, what part of the water conditioning should be done outside and what inside the boiler? What changes in composition must be made in the water? What methods of treatment will effect these changes most economically? What equipment should be used? How can the various processes be grouped or combined to provide the most efficient system of pretreatment?

One problem, for example, may be the removal of suspended solids from the water. In your particular situation, can this be satisfactorily accomplished by providing storage reservoirs in which to hold the water until solids settle to the bottom? Or is filtration a better answer? If filtration is required, what type of filtration plant should be used? What capacity should it have? Would coagulation be required? If so, what coagulant should be used?

Is softening required? Distillation will give water of the highest purity—but is it worth while from an economic standpoint in your case? Is a precipitation type softener indicated, or is the base exchange process preferable? In either case, which of the many versions of the process should be employed?

To what extent is deaeration necessary? What type of equipment should you use?

Basically the answer to any of these questions depends on the characteristics of the raw water, on the conditions under which steam is to be generated and used—and on the answers to the other questions.

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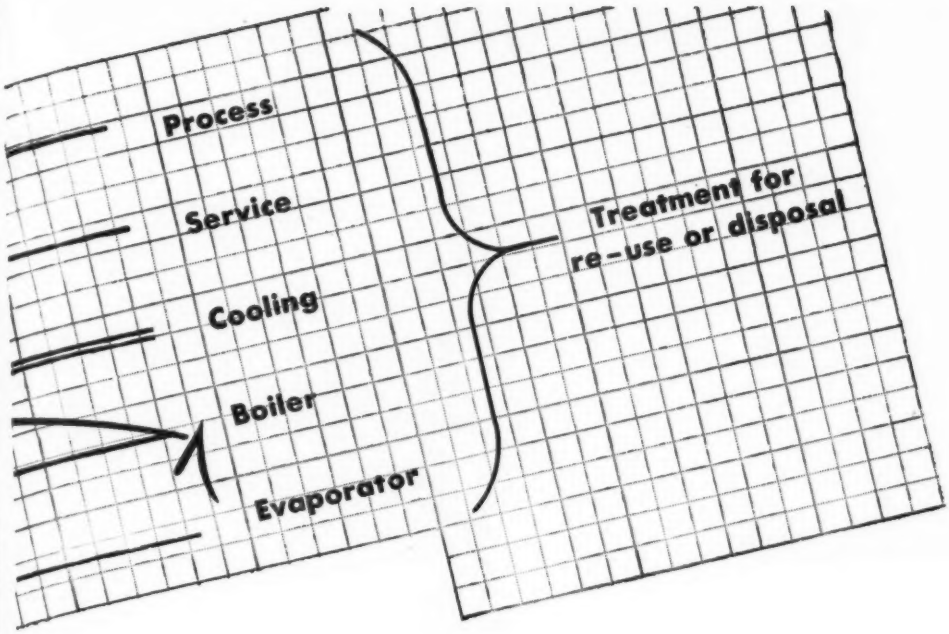

# of boiler makeup water

Here, for instance, are analyses of five typical samples of raw water (quantities expressed in parts per million):

Carbonate (CO_3)	0	0	0	10	0
Bicarbonate (HCO_3)	4	122	0	256	106
Sulfate (SO_4)	4	33	174	12	45
Chloride (Cl)	6	15	11	39	24
Silica (SiO_2—dissolved)	3	3	9	28	4
Iron (Fe)	....	....	13	....	....
Calcium (Ca)	2	37	29	20	31
Magnesium (Mg)	....	7	2	6	8
Sodium (Na—calc.)	5	16	53	100	27
Suspended solids	8	5	....	....	540
Total solids	32	238	292	471	785
Total soap hardness (Calculated as $CaCO_3$)	5	120	82	75	108
Total acidity (as H_2SO_4)			26		
Free acidity (as H_2SO_4)			3		

The differing problems posed by these water samples are, however, no more varied than those resulting from the wide range of operating conditions. Boiler operating pressure may be anywhere from about 100 to 2600 psi; steam temperature from saturation to 1,000°F. You may generate 1,000 pounds of steam per hour, or 1,000,000. All steam may be employed in driving turbines and other equipment, or varying proportions may be consumed in plant processes. Makeup water requirements may be virtually zero, or close to 100 per cent.

Whatever the conditions in your plant, Hall Laboratories is prepared to recommend procedures which in your specific situation will be the most efficient and economical. Correspondence on any industrial water conditioning problem is invited.

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

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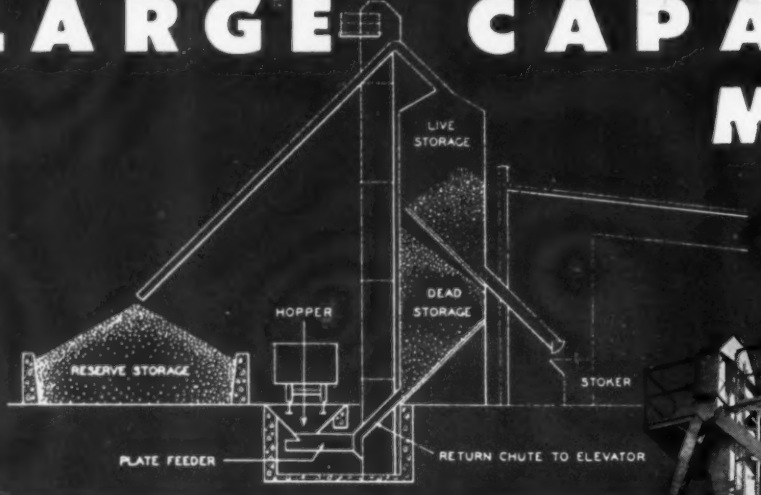
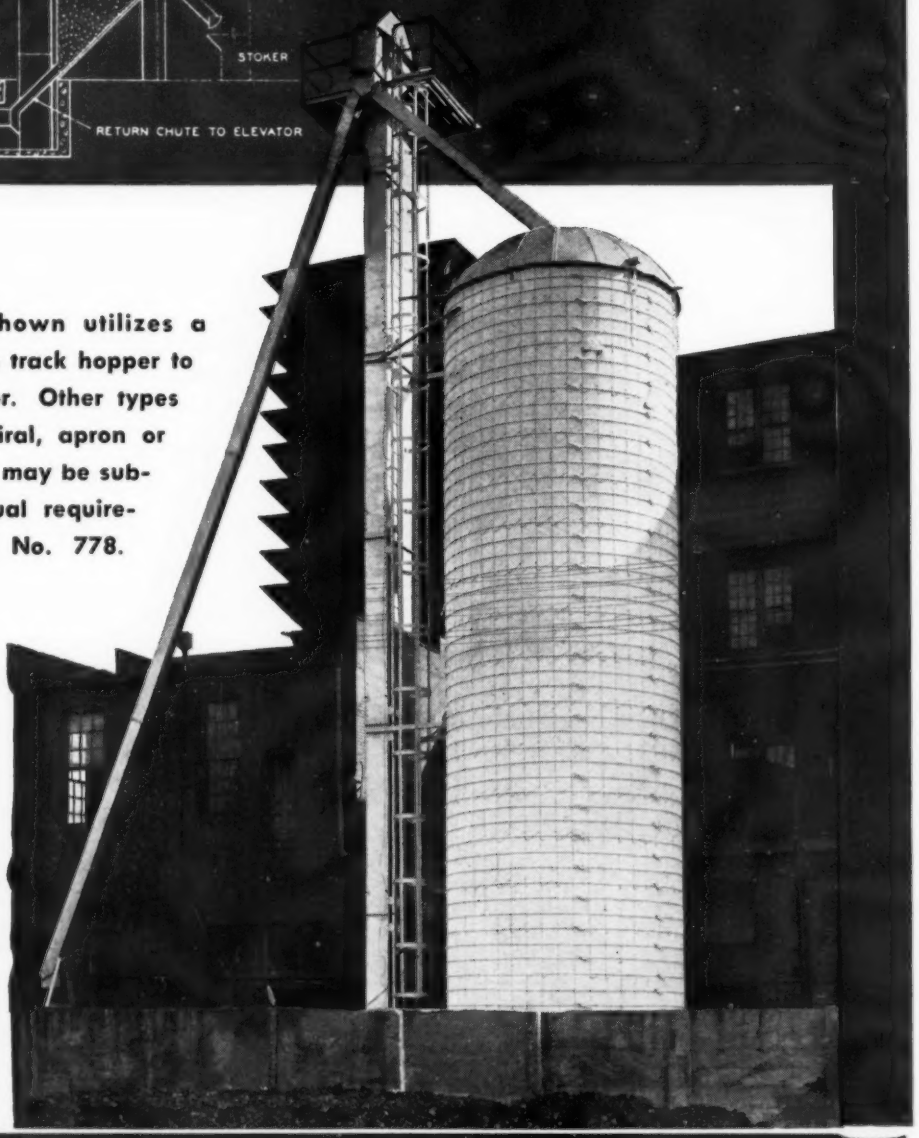
LARGE CAPACITIES MINIMUM SPACE



Arrangement shown utilizes a plate feeder from track hopper to the bucket elevator. Other types of feeders . . . spiral, apron or electric vibrating . . . may be substituted to fit individual requirements . . . Catalog No. 778.



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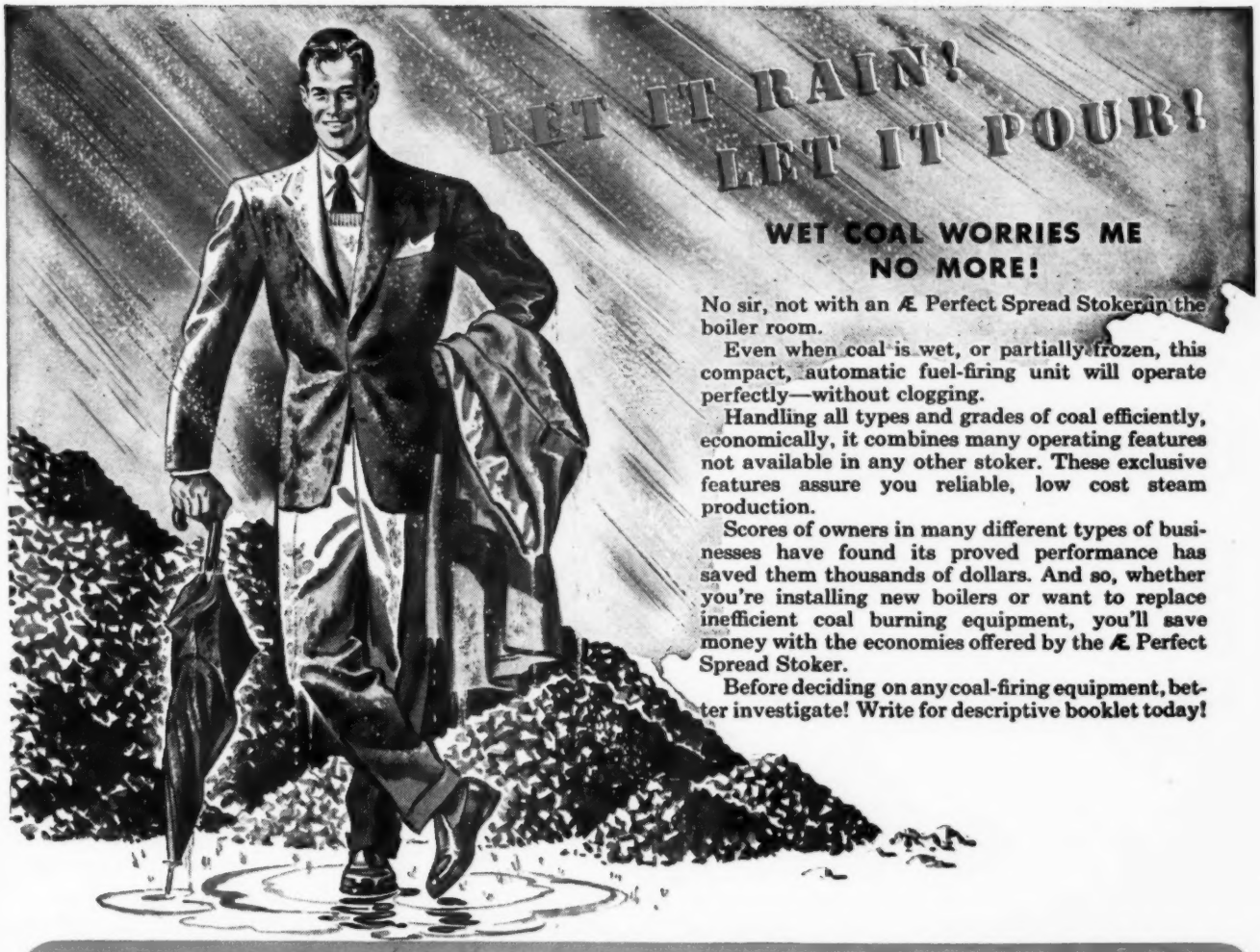

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No sir, not with an Æ Perfect Spread Stoker in the boiler room.

Even when coal is wet, or partially frozen, this compact, automatic fuel-firing unit will operate perfectly—without clogging.

Handling all types and grades of coal efficiently, economically, it combines many operating features not available in any other stoker. These exclusive features assure you reliable, low cost steam production.

Scores of owners in many different types of businesses have found its proved performance has saved them thousands of dollars. And so, whether you're installing new boilers or want to replace inefficient coal burning equipment, you'll save money with the economies offered by the Æ Perfect Spread Stoker.

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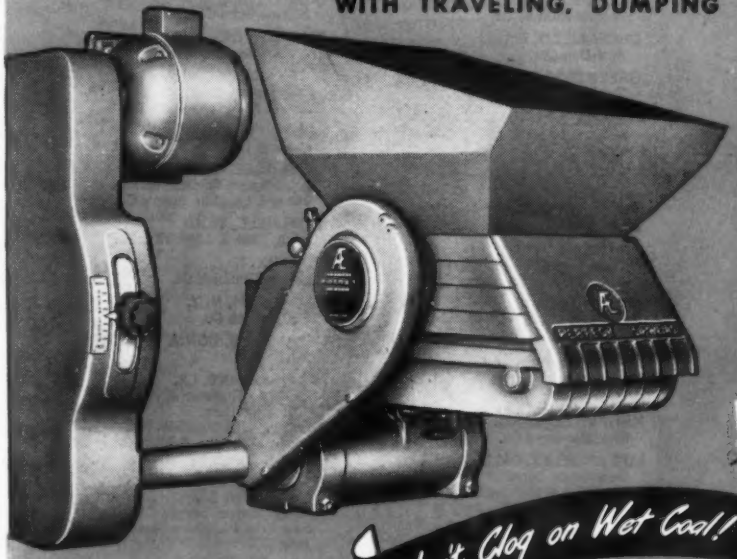

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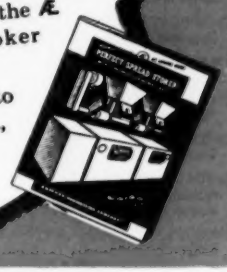

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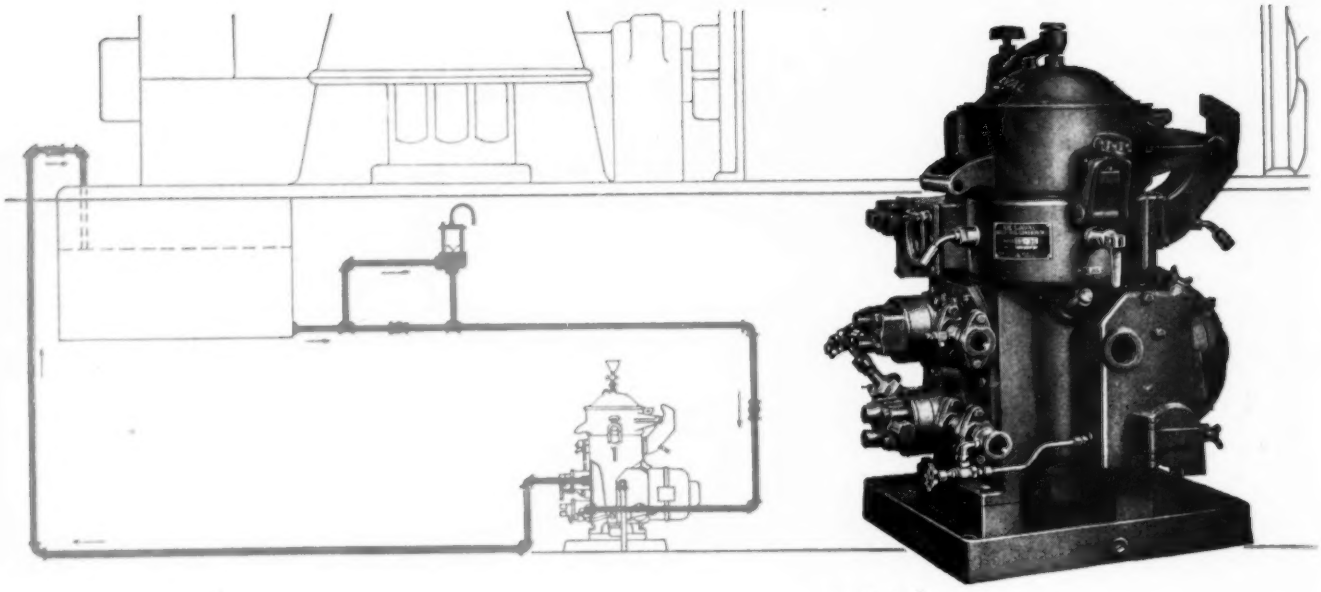

Condensate or dirt—
THIS OIL PURIFIER REMOVES BOTH PROMPTLY

A DE LAVAL Oil Purifier removes water and dirt by means of centrifugal force. Action is entirely mechanical — water is discharged as fast as it is separated from the oil; dirt is stored in the periphery of the bowl, out of the zone of purification.

The simplest of all continuous De Laval purification systems is the by-pass system shown above. Such a system utilizes a Purifier for each turbine unit, with a sight overflow glass. As purified oil is pumped back into the oil reservoir, it raises the oil supply level so that the dirtiest oil in the bottom of the reservoir flows through the sight glass to the Oil Purifier. The system may be installed either beneath the turbine (as shown) or on the turbine floor.

A De Laval Oil Purifier of proper size will pass the total quantity of oil in the reservoir through the Purifier three or four times daily, affording full protection to the turbine.

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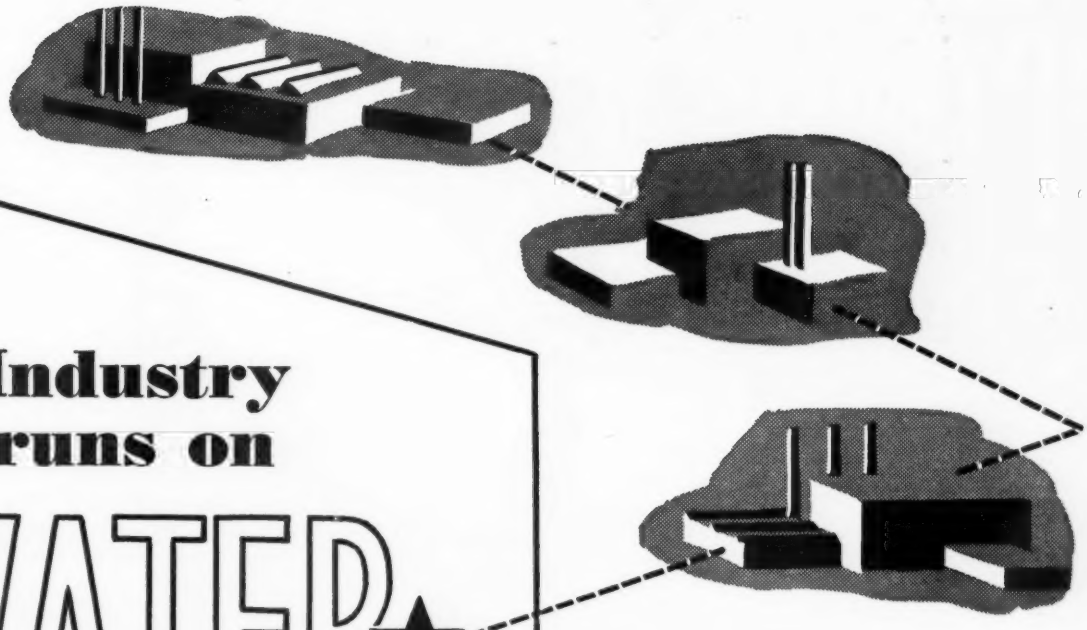
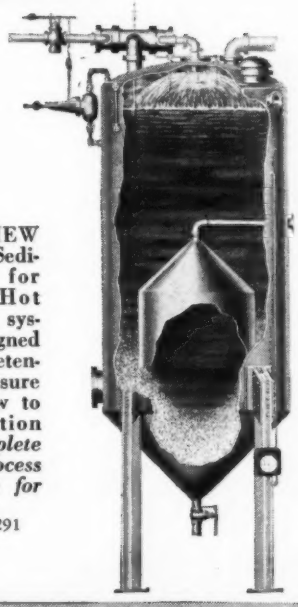


Industry runs on WATER

BUT WATER IS SELDOM SUITABLE FOR INDUSTRIAL PURPOSES WITHOUT SOME KIND OF TREATMENT

PREVENTION of scale, carryover and corrosion in power plants depends on the proper treatment of boiler feedwater. It means using the right kind of water conditioning equipment and chemicals, selected only after carefully considering such factors as the character of the raw water, amount of make-up, type of steam load, and the design characteristics of steam generators and prime movers. These and other essential considerations demand that you place your water conditioning problems in the hands of experienced experts who can select impartially from a complete range of water conditioning equipment.

Allis-Chalmers long and extensive experience in conditioning boiler feedwater for thousands of power plants — both high and low pressure — qualifies them to assist you in selecting the right kind of water treating equipment for your plant. Their "know-how," coupled with the complete range of Allis-Chalmers water conditioning equipment, is your assurance of the right solutions to your water treatment problems.



SECTIONAL VIEW of Reaction and Sedimentation tank for Allis-Chalmers Hot Process Softening system. Tank is designed to allow ample retention time . . . insure straight-line flow to minimize convection currents. *For complete details on Hot Process Softeners, write for Bulletin 28B6611.*
A 2291

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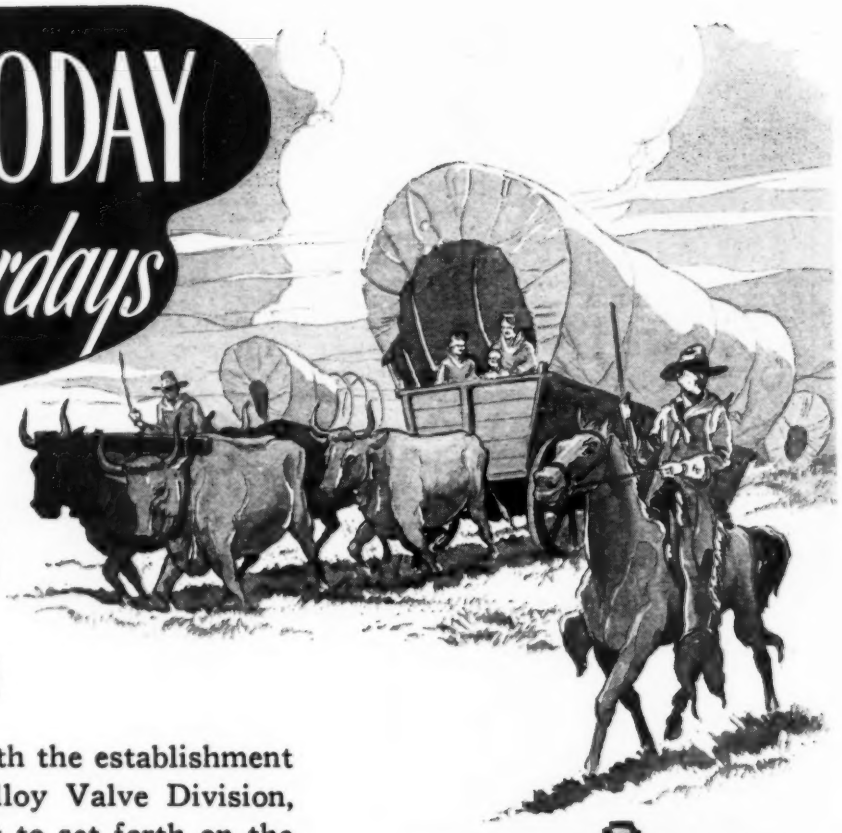

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The first bronze regrinding globe valve was a *Powell "first."*

And, twenty-five years ago, with the establishment of the Special Design and Alloy Valve Division, Powell Pioneers were the first to set forth on the trail to a line of corrosion-resistant valves for the chemical and process industries.

Today the complete Powell Line includes Bronze and Iron Valves of every required type, design, size and pressure; Cast Steel Valves of every type, in pressure classes from 150 to 2500 pounds; and, for the chemical and process industries, a complete line of Corrosion-Resistant Valves in many special designs and the widest range of pure metals and alloys ever used in making valves.

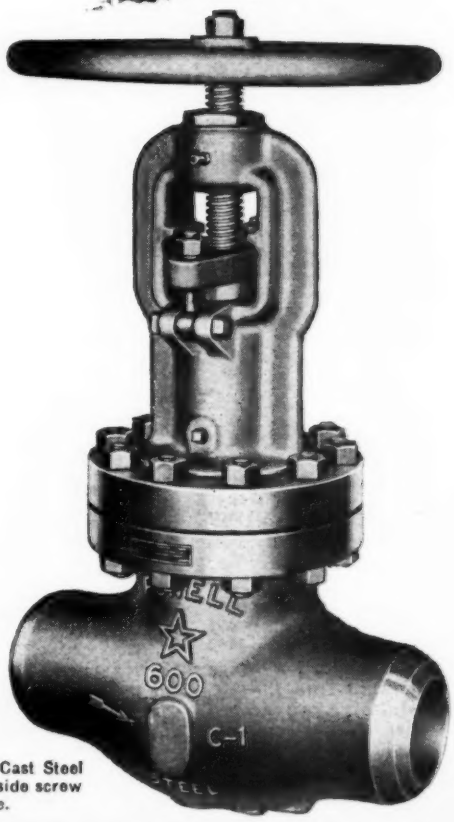

Fig. 6031 W. E.—Class 600-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

The Wm. Powell Company, Cincinnati 22, Ohio

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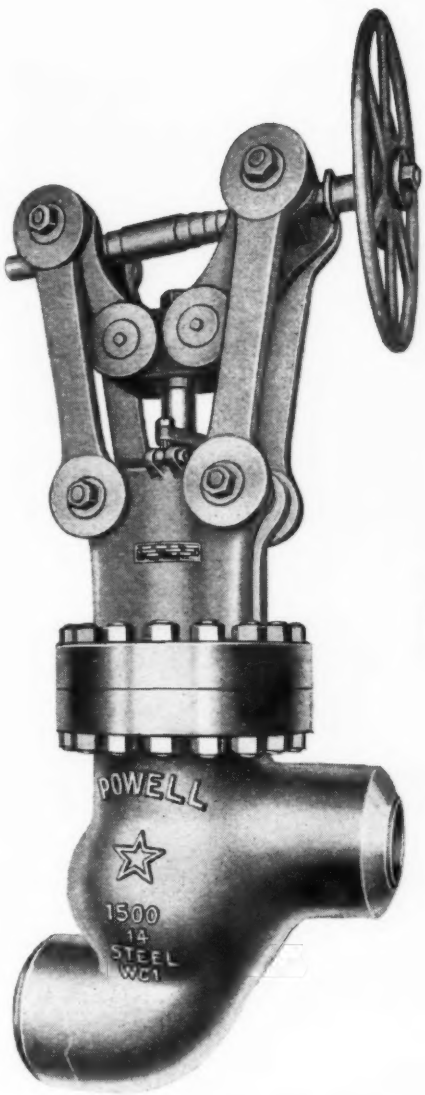


Fig. 1393—Class 1500-pound, 14", Cast Steel Non-Return Angle Valve with welding ends and bolted flanged bonnet. Toggle operated for easy opening and closing of valve.

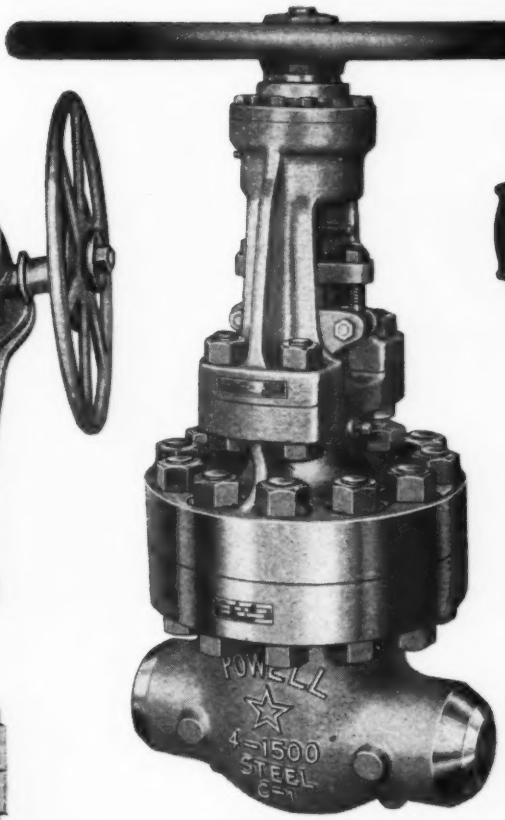


Fig. 1303 W. E.—Class 1500-pound Cast Steel Gate Valve with welding ends, outside screw rising stem and bolted flanged yoke.

Fig. 1323—Class 1500-pound, 8", Cast Steel Gate Valve with welding ends, welded bonnet and special by-pass. Top mounted electric motor operator provides quick, positive opening and closing by remote control.

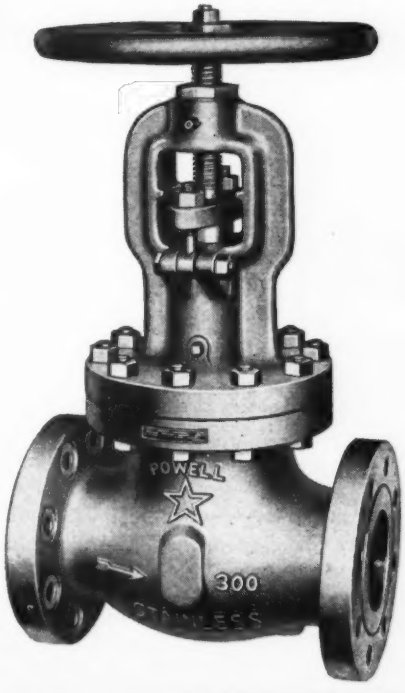


Fig. 3031 S. S.—Class 300-pound Stainless Steel Globe Valve, made to ASA dimensions and especially adapted for high pressure, high temperature boiler feed water treatment solutions. Has flanged ends, bolted flanged bonnet and outside screw rising stem. Also available with socket welding or butt welding ends.

Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

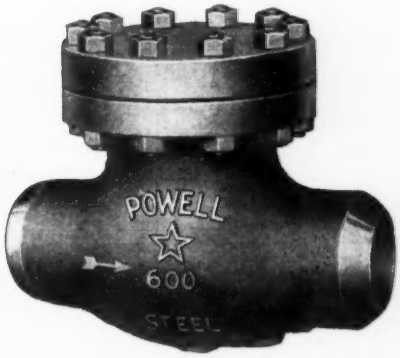
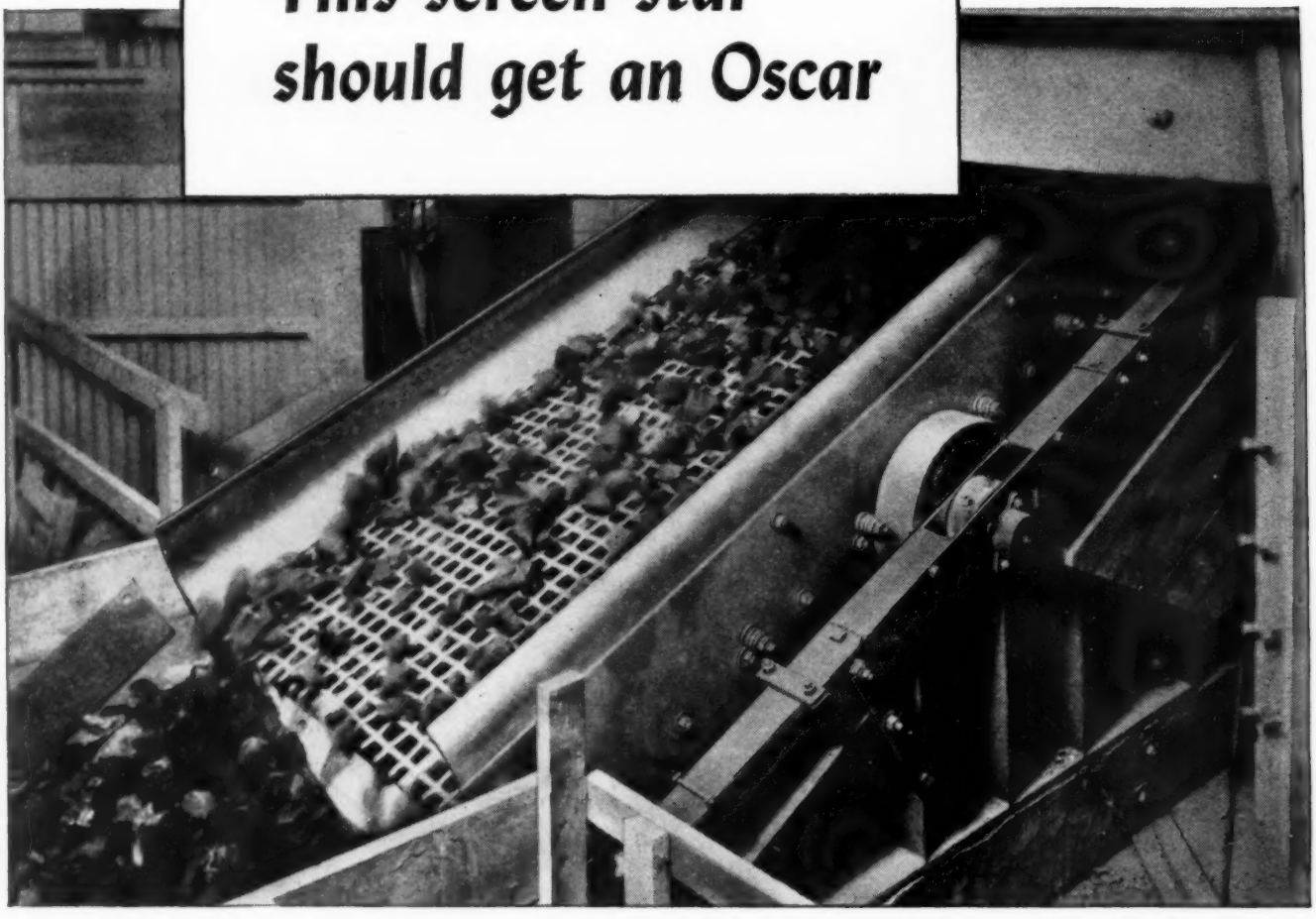


Fig. 6065 W. E.—Class 600-pound Cast Steel Horizontal Lift Check Valve with welding ends and bolted flanged cap.

VALVES

This screen star should get an Oscar



Here's a screen star that never acted before a camera. But she gets fan mail just the same!

It all goes back to the time when rock, coal, ore, and other materials had to be separated into sizes by slow and costly methods.

One way was to have men shovel the material against sloping sieves. Some of the small lumps would go through. Some wouldn't. You shoveled again and again . . . until they did.

Solving headaches like this is all in the day's work for Hewitt-Robins engineers. They developed the Robins Gyrex Screen. It's a vibrating screen that can size hundreds of tons of bulk material every hour. And it can separate as many as six different sizes at one time.

The Robins Gyrex Screen is designed for an almost endless variety of uses in industry. These range all the way from sizing coarse rock at a quarry to removing the tiny hairs from meat scrap at a soap plant.

No wonder the fan mail sent by so many users has said in effect: "*This screen star should get an Oscar!*"

The Robins Gyrex Screen is but one of many products "Job-Engineered" by Robins Conveyors Division to meet specific materials handling problems. These products include conveyors, Car Shakeouts and many types of vibrating screens.

In fact, there's a Robins product designed for virtually every materials handling need . . . built to speed up your operations . . . to help reduce your costs.

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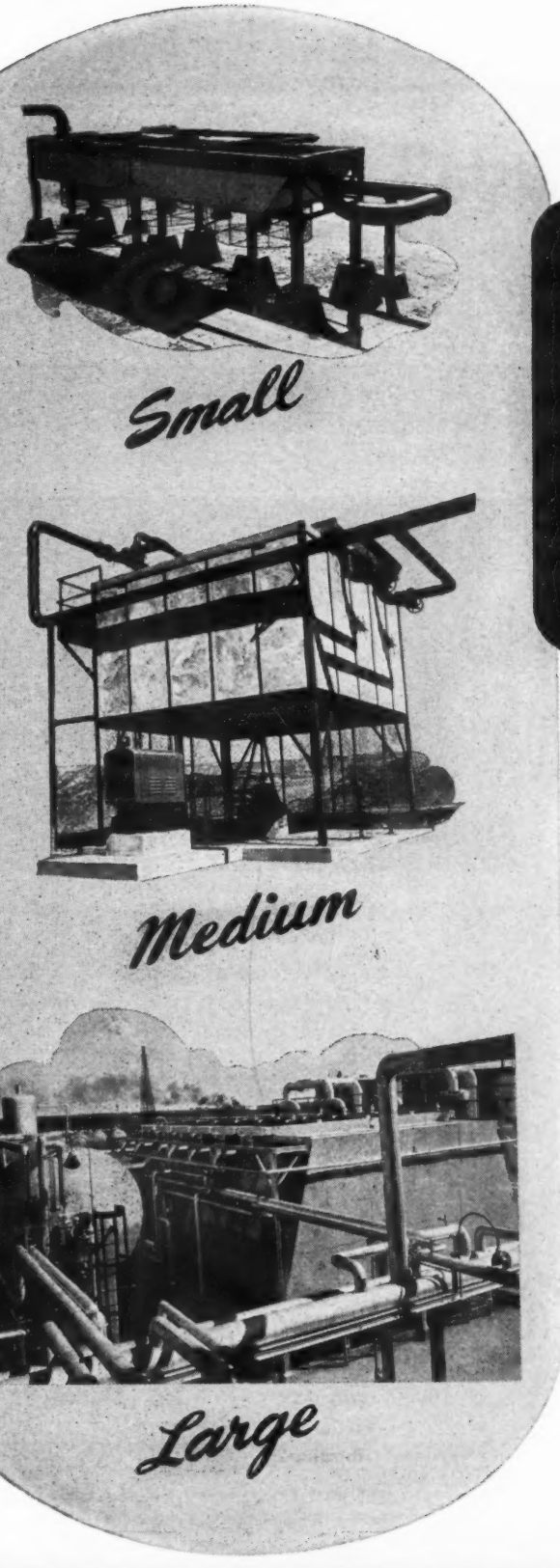
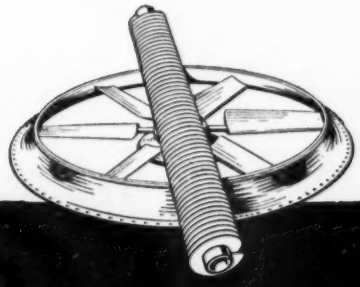
ROBINS GYREX SCREEN

ROBINS CONVEYORS DIVISION
HEWITT-ROBINS INCORPORATED
PASSAIC, NEW JERSEY





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Investigate this fully-proven and widely used unit. Its design, construction, and many important advantages are fully described in Bulletin 1230 which will be sent on request.

THE GRISCOM-RUSSELL COMPANY
285 Madison Avenue, New York 17, N. Y.

GR-114

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

For Best Results: Install CRYSTOLON Brick in Boiler Furnaces

The drawings and explanation below are based upon recent installations of Crystolon (Silicon Carbide) brick in boiler furnaces. Results have been completely satisfactory when the directions given here were followed.

Crystolon brick best demonstrate serviceability where there is need of uninterrupted peak operation. Produced at high temperatures these brick are particularly resistant to extreme heat. Their hardness makes them resistant to the abrasive action of ash and the motion of the fire bed.

The surfaces of Crystolon brick are sufficiently dense to prevent molten ash from taking hold by penetration and this same density enables them to resist the erosive action of slag.

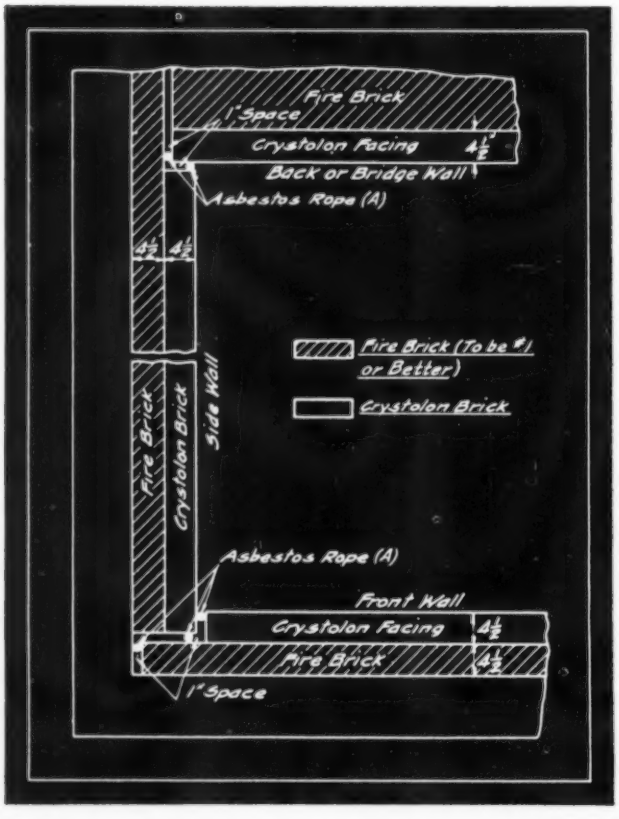


FIG. 1 *Typical Setting Showing Expansion Joints (A)*

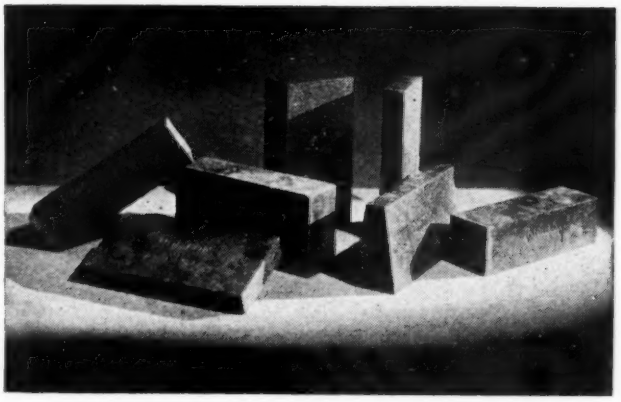


FIG. 2 *Crystolon Brick for Boiler Furnaces*

Other types of refractory brick often necessitate shutdowns or down-time to remove the clinker. While the clinker may sometimes adhere to Crystolon brick to a limited extent, these brick are sufficiently rugged to withstand the rather rough barring action that is commonly used to knock off the clinker.

Super refractory brick although costlier than ordinary fire brick actually give more economical service through reduced maintenance time and longer life.

It is advisable to use the same construction in the bridge wall as is shown (Fig. 1) for the side wall when Crystolon brick are used.

In cases where it may not be convenient to put in expansion joints as shown (see A, Fig. 1), expan-

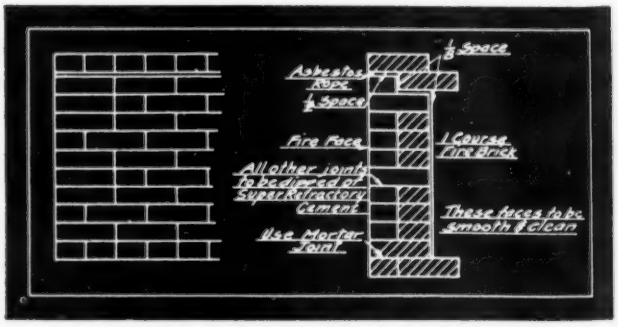

⅛" Space
Asbestos Rope
½" Space
Fire Face
1 Course Fire Brick
All other joints to be dipped of Super Refractory Cement
These faces to be smooth & clean
Use Mortar Joint

FIG. 3 *Construction Using from 9 Courses up to 4' of Crystolon Brick*

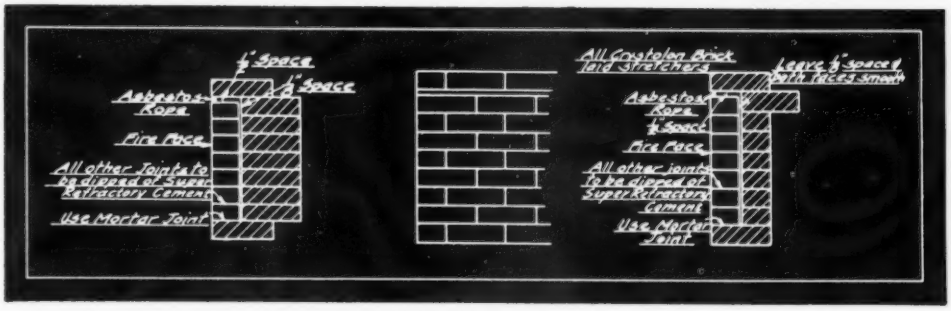

½" Space
½" Space
Asbestos Rope
Fire Face
All other Joints to be dipped of Super Refractory Cement
Use Mortar Joint
All Crystolon Brick laid Stretchers
Leave ½" space & both faces smooth
Asbestos Rope
½" Space
Fire Face
All other joints to be dipped of Super Refractory Cement
Use Mortar Joint

FIG. 4 *New Construction (left) and Repairing Old Construction (right) Where 7 Courses or Less Are Used*

sion can be taken care of by leaving $\frac{1}{16}$" to $\frac{1}{8}$" open joint between each brick in the stretcher courses or every second brick in a header course. In any case, expansion allowances must be made. A good rule to use is approximately $\frac{1}{8}$" expansion to 15" of Crystolon brick in the wall.

For best results, not less than five courses of Crystolon brick should be used in any boiler furnace except in cases where exceptionally thin fire beds are carried and peculiar conditions of operation might justify the use of fewer courses.

In general, five to nine courses are used depending on the type of stoker, size of furnace, thickness of fuel bed carried and rating at which boiler is to be operated. If too few courses are used, there is danger of a slag curtain building down from the fire brick above and interfering with the efficiency of the Crystolon brick.

Always use a super refractory cement* for laying up the Crystolon brick. A dipped joint is best in laying Crystolon brick, unless otherwise specified. The brick should be hammered down tightly to make as nearly a face-to-face joint as possible. *Do not use ordinary fire clay or fire brick cements nor any of the groups known as air-setting or air-hardening cements in contact with the Crystolon brick.*

*Send for Norton Refractory catalogs: Cement No. 863-Crystolon Brick No. 862.

In the center retort, side-dump type of stoker the Crystolon brick should be started 3" below the nose of the dump plate.

In the multiple retort type of underfeed stoker the Crystolon brick should start at the grate line and follow the slope of the stoker, using a few more courses of Crystolon brick in the side wall toward the rear of the stoker. It is well to use standard jamb or bull nose and arch brick to build around the rear inspection door.

In the chain grate type of stoker the Crystolon brick should be laid directly on the side wall bed plate or in any case should start slightly below the top of the chain grate. In the case of one type of Cox stoker now in use a special Crystolon brick is employed with a $\frac{1}{2}$" cut-out which fits directly over the side wall plate.

In hand-fired boiler furnaces it is common practice to start the Crystolon brick an inch or two above the top of the grate.

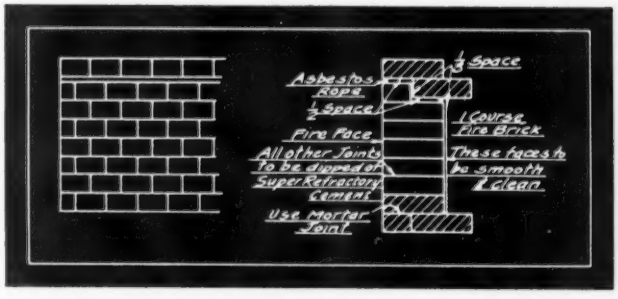
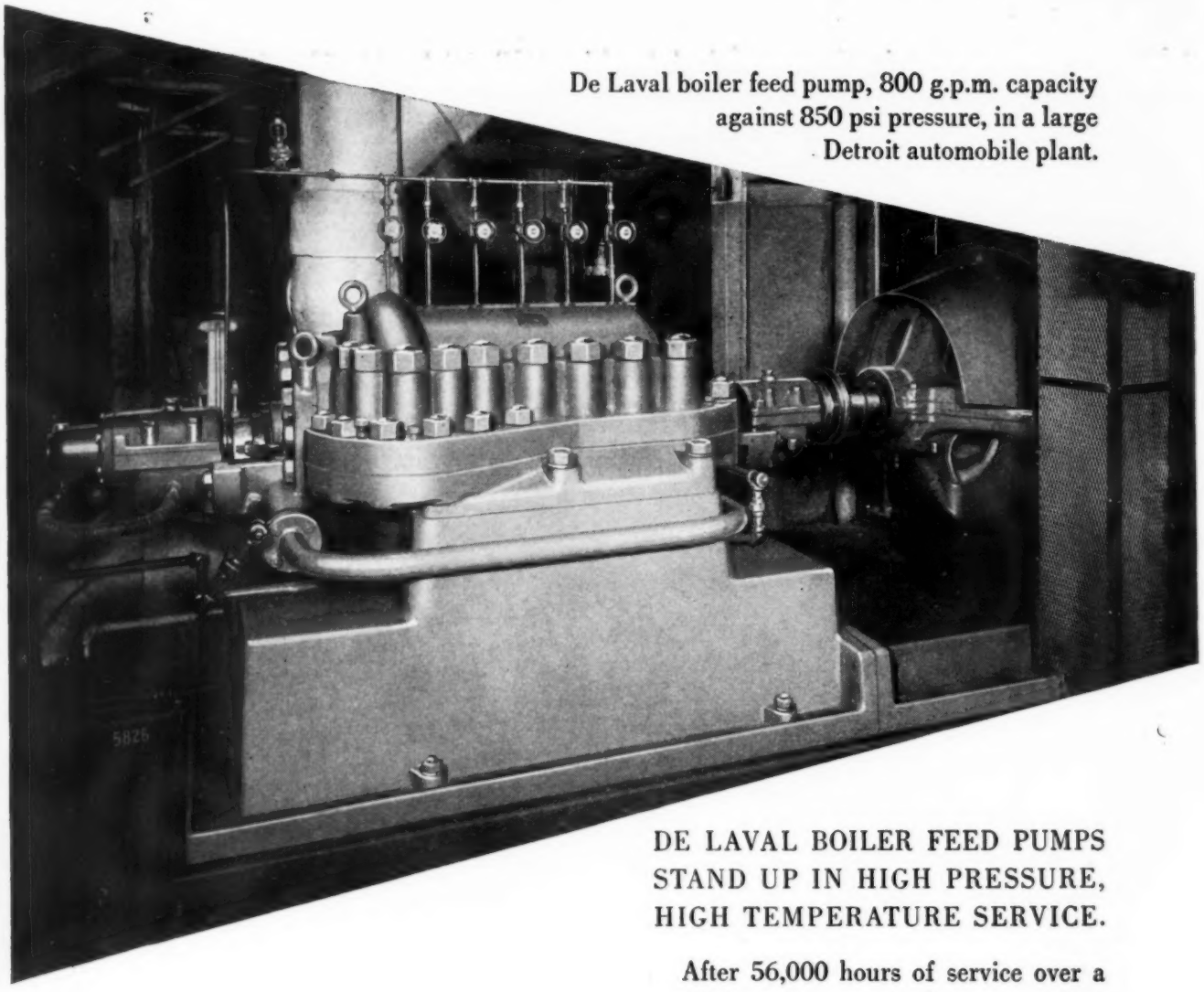

½ Space
Asbestos Rope
½ Space
Fire Face
All other Joints to be dipped of Super Refractory Cement
Use Mortar Joint
1 Course Fire Brick
These faces th be smooth & clean

FIG. 5 *Construction Using 9" Crystolon Wall All Headers up to 4' in Height*

NORTON REFRACTORIES LIKE HEAT

NORTON COMPANY - Worcester 6, Mass.



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reports inspector

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"We completely disassembled the pump and found wheels, diaphragms, shaft, bearings and all other parts in excellent condition. There was no washing of the pump case or any kind of corrosion. The shaft sleeve was highly polished. Balance parts including labyrinth leak off and the leak off bushing over the discharge end of the shaft sleeve hubs had but .005" wear."

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AUGUST 1947

VOLUME 91, NUMBER 8

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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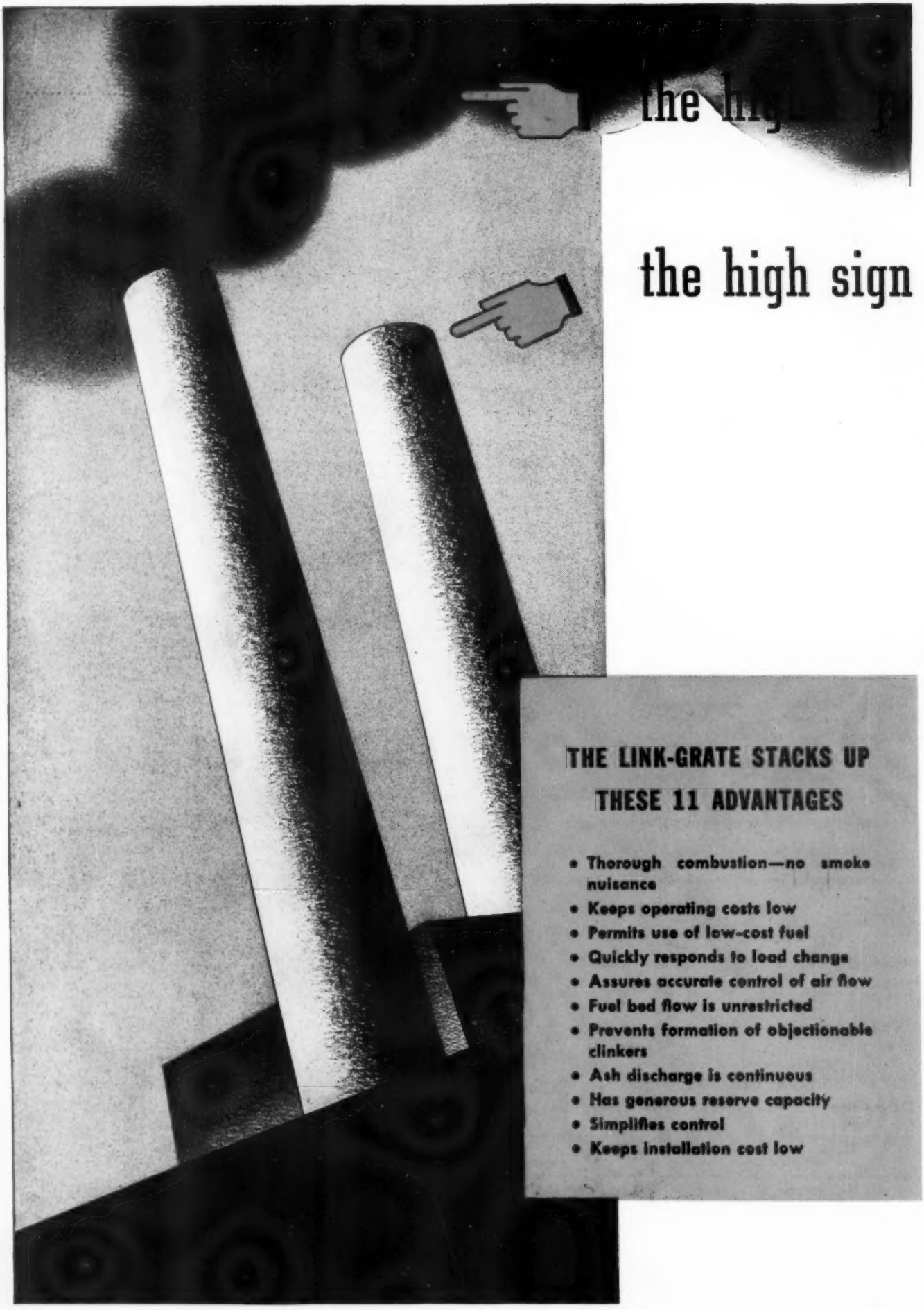

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efficient combustion

of a *Link-Grate* stoker

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You'll get less smoke—and, of course, more power—per pound of coal with a Westinghouse Link-Grate Stoker. That's been proved in one installation after another . . . and it's a fact that will win approval from your own fuel cost sheets, from the Smoke Inspector and your neighbors.

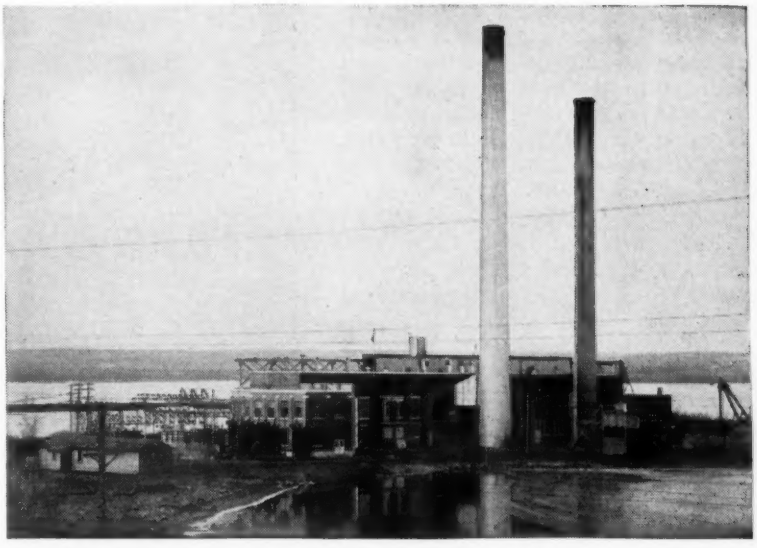
The Link-Grate action does all this by maintaining a regular combustion rate because it continuously processes the fuel bed to keep it porous. With this action, positive motion at the rear of the stoker permits uniform flow of coal over the underfeed section to keep the burning lanes open.

In Link-Grate action, the grates first hinge up to break open the fuel bed and let low pressure air flow through the grates. The reverse movement of the grates crumbles and conveys the burning fuel.

Because of this conveying movement of the Link-Grate, ash comes off the ash discharge plate continuously—doing away with periodic dumping and reducing labor. Clinkers are not a problem.

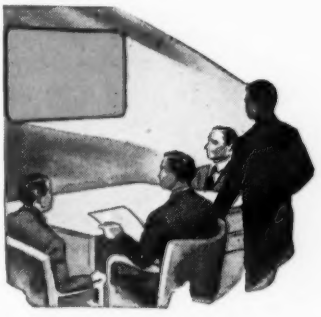
Since the fuel bed is always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

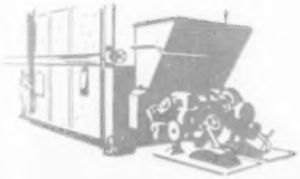
Get the complete information about the Link-Grate before you make an investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50469



Almost no smoke is coming out of the stacks although the boilers are in operation at this power plant of the Lake Superior District Power Co. at Ashland, Wisconsin. In this installation are two 6-retort, SDL-29 Link-Grate Stokers. (Photograph is not retouched.)

Show Link-Grate Movies in Your Own Office. A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.





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Link-Grate STOKERS

BYERS WROUGHT IRON picked to give this tank greater life expectancy

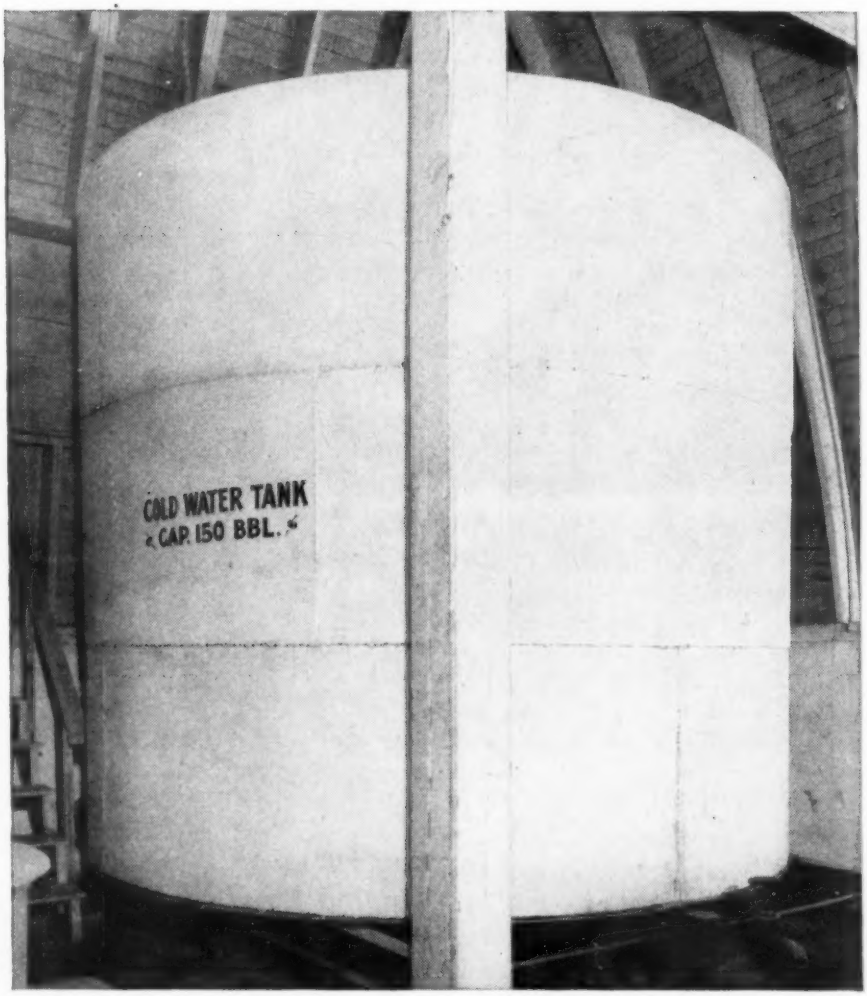
One of the biggest plant maintenance problems is frequently created by the handling and storage of plain, ordinary water. Although it is pure and potable, water can eat vulnerable metals like some corrosive chemical. This problem is aggravated in the case of tanks, where repairs and replacements are difficult and expensive.

The Latrobe Brewing Company, Latrobe, Pa., had such a problem when they recently replaced a large cold water storage tank, located inside the building. The company uses wrought iron in a number of services—cold water, steam supply and return, and brine and ammonia lines—and so had first-hand opportunities to verify its excellent service qualities. The new tank was fabricated from Byers Wrought Iron plates. Welding was done at the site, as due to limited space the tank could not be moved into place complete.

There is ample evidence to support this choice in the many records of wrought iron tanks that have served for forty years and more. In many instances, these tanks were located outdoors, and so exposed to external, as well as internal, corrosive attack. Users report a tank in Ohio, still serving after 47 years; in Mississippi, a tank still serving and in good condition after 42 years; Kentucky, Florida and South Dakota each have tanks that were still on the job after 45 years.

The superior service of wrought iron is not due to surface coatings, but to inherent resistance. Tiny fibers of glass-like silicate slag, threaded through the entire body of high-purity iron, halt and "detour" corrosive attack. They also help to anchor the initial protective scale, which shields the underlying metal.

If your plans include the construction of any new tanks, or the replacement of old tanks that have not given anticipated service, you will find some helpful information in our bulletin, "Wrought Iron for Tank Construction." Ask for a complimentary copy.



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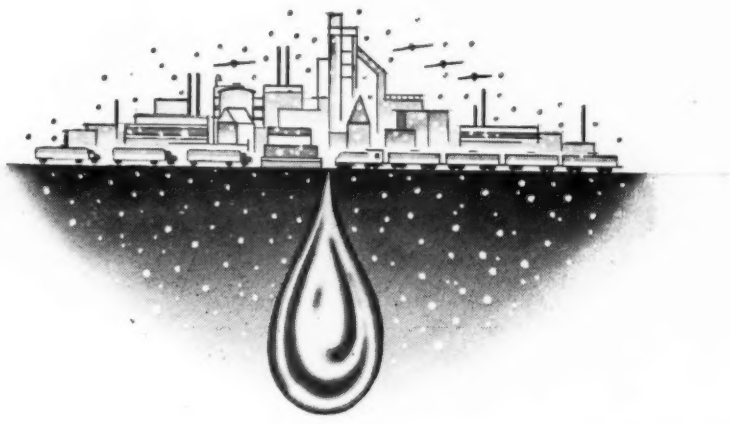

NEXT WINTER'S OIL?

USERS OF FUEL OIL will be wise to plan on meeting a tight supply situation this coming winter. Stated briefly, here are the reasons:

Demand for petroleum products, now at an all-time high, has far outstripped forecasts. Figures for1947's first quarter reveal gasoline requirements up 30% against 1941, and heating oils up even more, 50%. Best estimates put 1947 total needs 7% above 1946, if weather is normal and there is a slight business recession. A tough winter and continued high-level business activity will raise this percentage substantially.

On the supply side, the problem is all above ground —the oil is there, underground, and it can be produced to keep pace with needs. But nearly everything on the surface—refineries, pipelines, tank cars, tankers and storage facilities—is short, with transportation the major bottleneck.

Refinery capacity has increased about 20%, but building programs lag for lack of steel and critical components. Working at full output, refineries could probably hold the 5-million-bbl-per-day rate needed, but full output depends on deliveries of crude oil. All the way from well to refinery, to distribution points, and to the consumer, success in supplying the demand rests on the adequacy of transportation.

Since little can be done between now and the winter peak period to bring new transportation into action, principal hope lies in maximum utilization of existing facilities. Among other things, this means expanded use of higher-cost rail shipment, with quicker turn-around on tank cars, increased barge movement to the Middle West, full use of pipelines and tankers. It may require a system of allocations to insure orderly handling of crude and products between fields, refining centers and distribution areas. The oil industry and government may be expected to act vigorously along these lines.

For the power engineer, the crucial fact is that the evidence points to a tight situation in the months to come. If the threat is forestalled by warm weather, a slackening of business activity, or by industry action, all well and good. The essential need is to be prepared for the worst.

First step in preparedness calls for maintaining maximum storage. Record use of fuel oil last winter, largely the result of installation of a million and a half oil burners and space heaters in 1946, delayed building up of stocks for the 1947-48 heating season. Instead of beginning in March, as is normal, this did not get under way until the middle of May. Thus maximum storage all along the line is a must, and power engineers can help by keeping full tanks.

When everything possible has been done to secure and maintain supplies, the power engineer may still find himself short of his requirements. For this shortage there is no answer but full exploitation of his fuel-saving ingenuity—accelerated action along the lines of his day-by-day task of making every Btu count.

Remembering the miracles worked during the war years to make drastically curtailed petroleum supplies go around, there is every reason to believe that the oil industry and the users of its products, working in full cooperation, will come through. We've got a job to do—let's get at it!

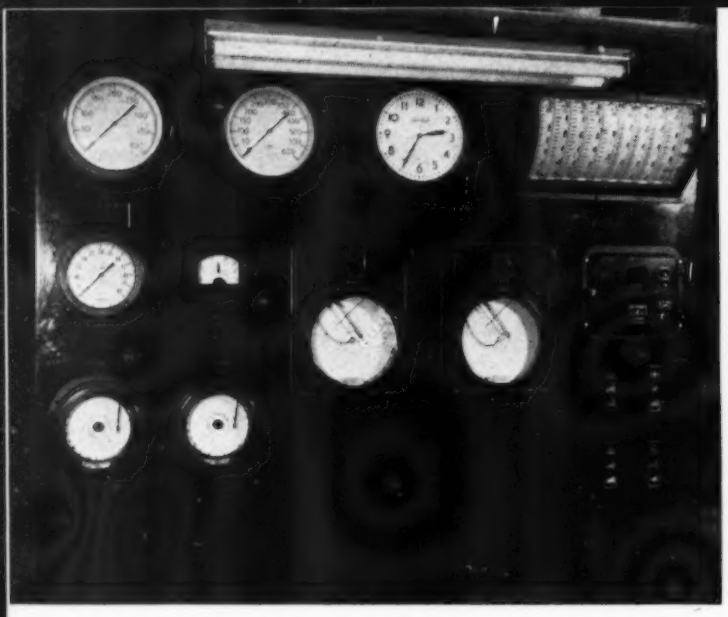

Fig. 1—Operation of the black-liquor chemical-recovery boiler is in general under hand control, but is provided with meters to show how every part of system performs

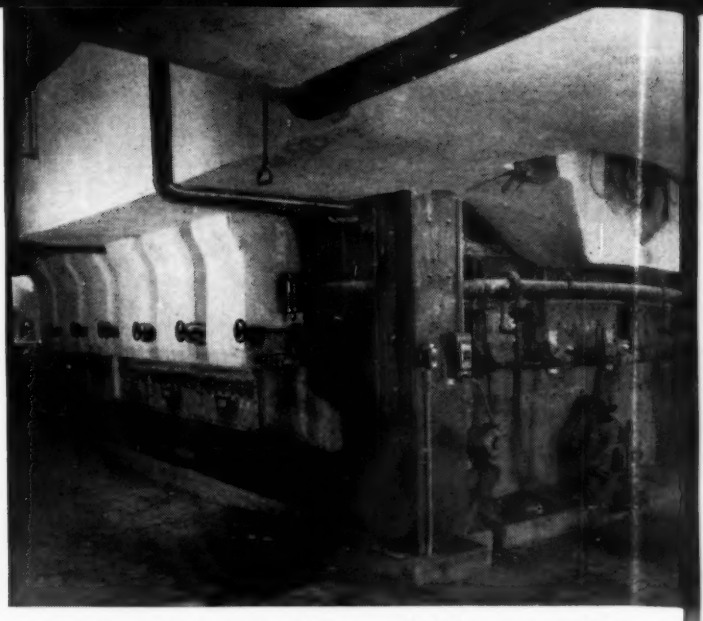

Fig. 2—Chemical-recovery furnace and boiler at operating floor. Preheated-air ducts above with connections to air nozzles entering furnace at left near floor level

Byproduct Steam Cuts Fuel Cost In Large Pulp and Paper Mill

Pulp and paper mill uses excess hydro in electric steam boiler, burns bark from pulpwood and black liquor from pulpmaking. Thus much of its steam is produced, a serious waste-disposal problem solved, valuable process chemicals recovered, reused

A MODERN PULP AND PAPER mill requires large quantities of steam for cooking, drying and heating. By proper design most of this steam can be provided as a byproduct of mill operation; at the same time, this practice eliminates difficult problems of waste disposal. The way the new sulphate-pulp and paper mill of Kalamazoo Vegetable Parchment Co does the job demonstrates the whole range of steam-production possibilities in such plants.

The company selected Espanola, Ontario, Canada, as the most favorable site for a mill to supply a large part of the 250 tons of pulp per day for its many and varied paper products. As a nucleus around which to build, an idle newsprint mill was purchased along with a water-power plant.

Redesigned Plant. The company's engineers, with O C Schoenwerk and H G Acres Co as consulting engineers, redesigned the plant to produce 200 tons of bleached sulphate pulp, 100 tons of paper and 40 tons of ground wood per day. When all divisions of the mill are completed it will be one of the most modern in operation.

Raw materials, in the form of wood, limestone, salt-cake and salt, are converted into high-grade bleached sulphate pulp paper. Practically all waste from production processes will be reclaimed or used to produce process and heating steam.

All mill power is obtained from a 20,000-hp water power plant on the property. Part of this plant has been rebuilt to increase its hydroelectric capacity and to adapt it to the new mill's needs.

Steam is supplied from four sources (1) a 5000-kw electric boiler that utilizes excess hydroelectric power (2) two boilers fired with bark and woodwaste (3) a chemical-recovery unit fired with black liquor from the digesters (4) three coal-fired boilers. Steam from the first three sources is a byproduct from manufacturing operations; in summer it supplies practically all mill requirements.

Electric Steam Boiler. A 5000-kw 2300-v electric steam generator, good for 20,000 lb of steam per hr at 175 psi, uses excess power from the hydroelectric plant. This power is generally available for the boiler except during the coldest months. Minimum water flow occurs in this period because of precipitation held in the snow blanket, and water converted to ice in rivers and lakes.

This boiler is a recirculating type like Fig. 3. Power is supplied at 2300 v from the power plant's busbars and its steam outlet connects directly to the plant's main steam header. Steam output is regulated by controlling feedwater conductivity and electrode emersion.

In this unit, feedwater is maintained automatically at a constant level in the bottom of the boiler. From here it is discharged to the basket above and is heated to steaming temperature by current flowing between three electrodes. Each electrode connects to one leg of the 2300-v power system. Throttling circulating-pump discharge controls water level in the basket. Opening the discharge valve increases the water level

and electrode emersion and, consequently, the steam rate. Conversely, decreasing the water level by throttling the pump's discharge decreases the steaming rate. To maintain proper control of steaming rate, water conductivity must be maintained within specific limits.

Bark-Burning Boilers. Woodwaste and bark provide a second source of by-product steam. The old paper mill's boiler plant had 14 stoker-fired 175-psi boilers of various sizes and ages. For the new mill two of these units, with 4100 sq ft of heating surface each, and good for 14,500 lb of steam per hour at 175 psi, were reset in dutch-oven furnaces, Fig. 4. These units have Combustion Engineering Type E stokers for burning either coal or bark, or both, simultaneously, also forced- and induced-draft fans and air heaters. Bark is burned directly on the stokers, which are charged with coal at all times, ready for immediate use when required.

Bark and wood as fired contain 50 to 60% moisture. For high combustion rates at good efficiency this moisture must be rapidly evaporated, chiefly by radiant heat from furnace walls and roof. Because of its high volatile content about 75% of combustible in the bark and wood burns in suspension, and should be treated as a gas rather than a solid fuel.

Furnace Design. The furnace, Fig. 4, is designed to (1) maintain high temperature over the whole area of the fuel bed (2) obtain rapid evaporation of the moisture and distillation of the volatile from the fuel (3) give control of the underfire and overfire air (4) cause intense turbulence in the combustible gas and air (5) obtain long flame travel. All these factors are highly important to burn wet bark and waste wood efficiently at high combustion rates.

The dutch oven, Fig. 4, may be considered a primary furnace and gas producer, separate from a secondary furnace under the boiler but connected to it by a shallow throat. The stoker's rear end and its grates are set back nearly 4 ft from the boiler's front. The grates of many early dutch ovens were placed where a part of their fuel bed was exposed to and chilled by heat-absorbing surface of the boiler.

A bridgewall, 5 ft, 6 in. high, at the stoker's rear extends 3 ft, 6 in. above the lower edges of the grates. This wall (1) supports the stoker's rear end and grates (2) helps isolate the fuel bed

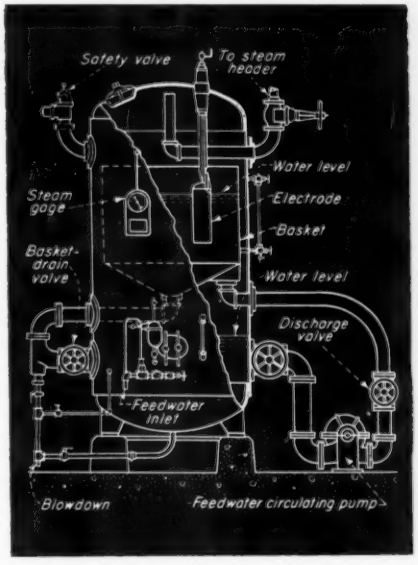

Fig. 3—Power is supplied to a 5000-kw electric boiler direct from powerhouse busbars at 2300 v to produce 20,000 lb of steam per hr at 175 psi

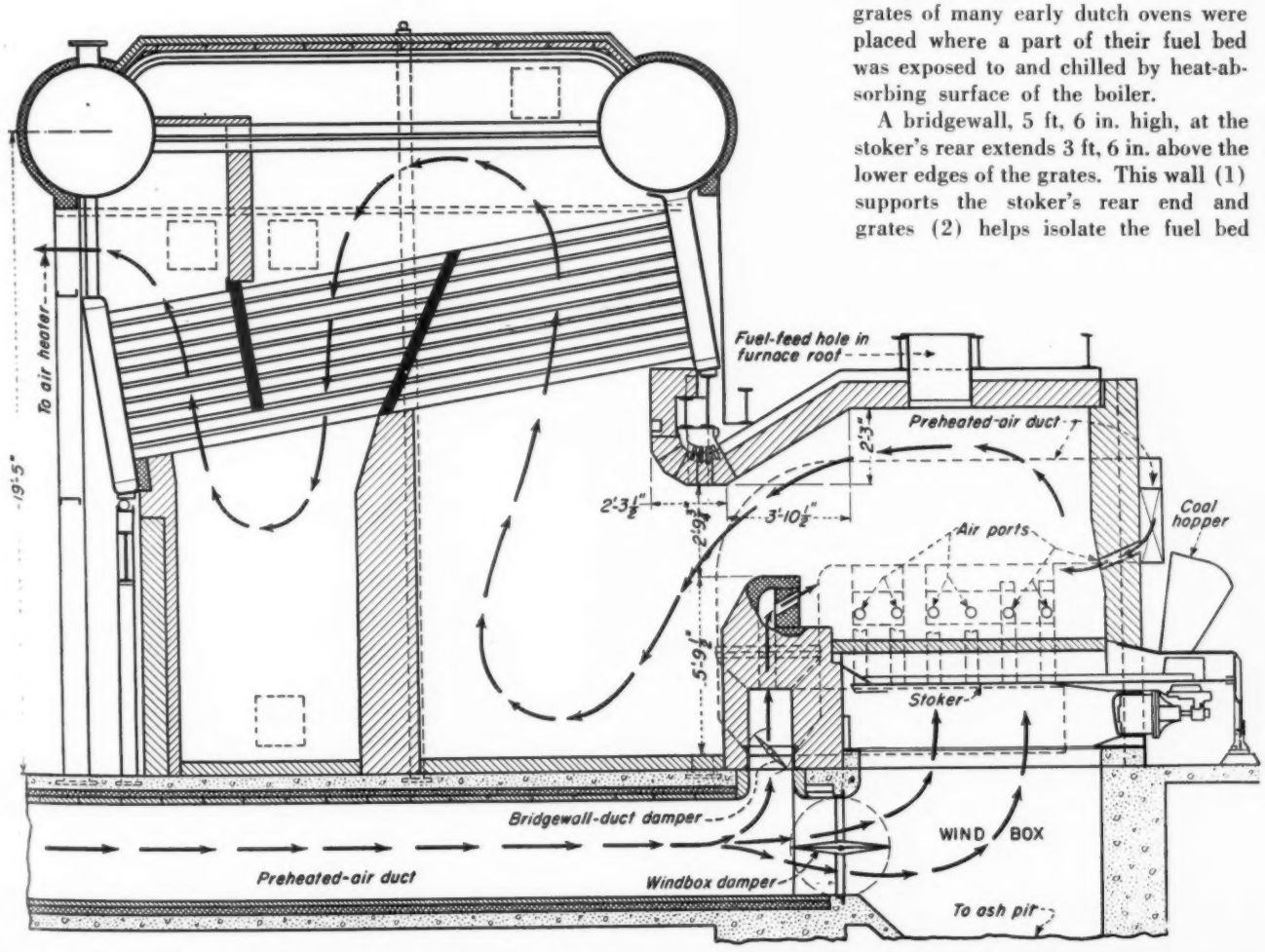

Fig. 4—Two old 175-psi boilers, each good for 14,500 lb steam per hr, are set in dutch-oven furnaces with underfeed stokers. They burn coal or bark, or both, at same time, have forced- and induced-draft fans, air heaters

from the boiler's heat-absorbing surfaces (3) creates turbulence by restricting the gas passage to the secondary furnace under the boiler (5) in combination with the dutch oven's roof increases flame travel (6) contains duct and ports for overfire air.

Some earlier dutch ovens had flat roofs that ended at the boiler front. These had little tendency to produce turbulence and permitted the gas stream to turn directly up into the boiler with minimum travel. In Fig. 4, beginning 4 ft from the boiler, the furnace roof slopes down 2 ft, 3 in. toward the furnace floor and extends an equal distance under the boiler.

The downward slope of the arch: (1) provides an incandescent refractory surface from which heat is radiated directly to the fuel-bed rear (2) restricts the gas passage to the secondary furnace to cause intense turbulence (3) directs the flame toward the secondary-furnace bottom to increase its travel and turbulence. The roof's nose is placed beyond the top of the bridgewall so the two combine to produce a gas passage that points toward the secondary-furnace bottom. As a result, gas flow from the dutch oven into the boiler follows a path somewhat like that indicated by the heavy arrows. This path is one that gives maximum gas travel.

Combustion Air. Preheated-air ducts bring 400-F combustion air into the windbox under the stoker and grates and to the overfire ports in the furnace sides, front and bridgewalls. The bridge and the side walls are thick enough to contain air ducts for the ports. Front-wall overfire air ports are supplied by a sheet-steel duct connecting to the bridgewall's preheated-air duct.

Each furnace wall has six ports. In the front wall the ports incline downward toward the fuel bed at an angle of about 30 deg whereas bridgewall ports incline upward at a similar angle and the side-wall ports are horizontal. Having the air come into the furnace at different angles and from the four sides of the fire produces in the burning gases an intense turbulence. It is further heightened by (1) air from the bridgewall ports discharging at an upward angle into the oncoming gas stream (2)

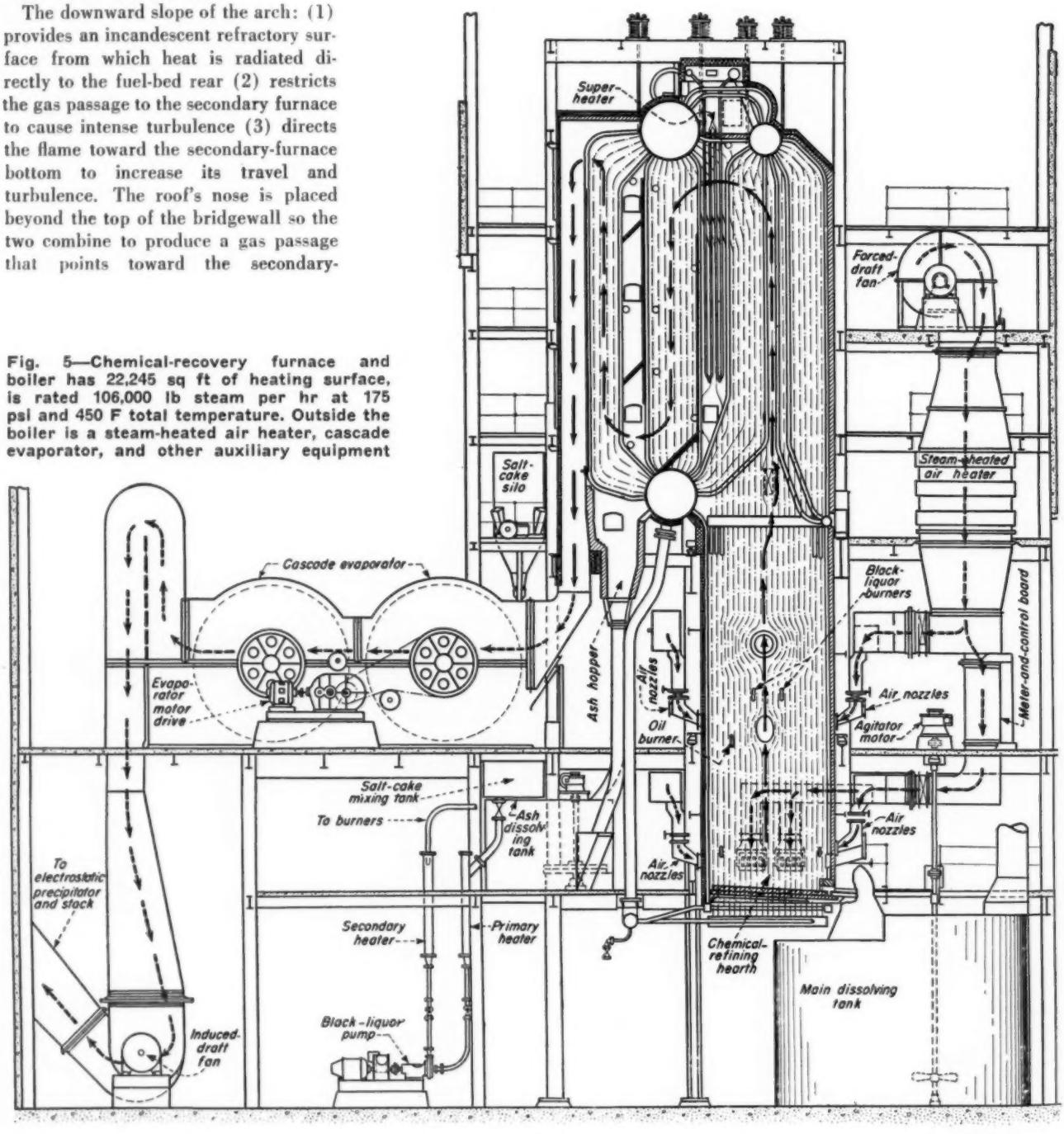

Fig. 5—Chemical-recovery furnace and boiler has 22,245 sq ft of heating surface, is rated 106,000 lb steam per hr at 175 psi and 450 F total temperature. Outside the boiler is a steam-heated air heater, cascade evaporator, and other auxiliary equipment

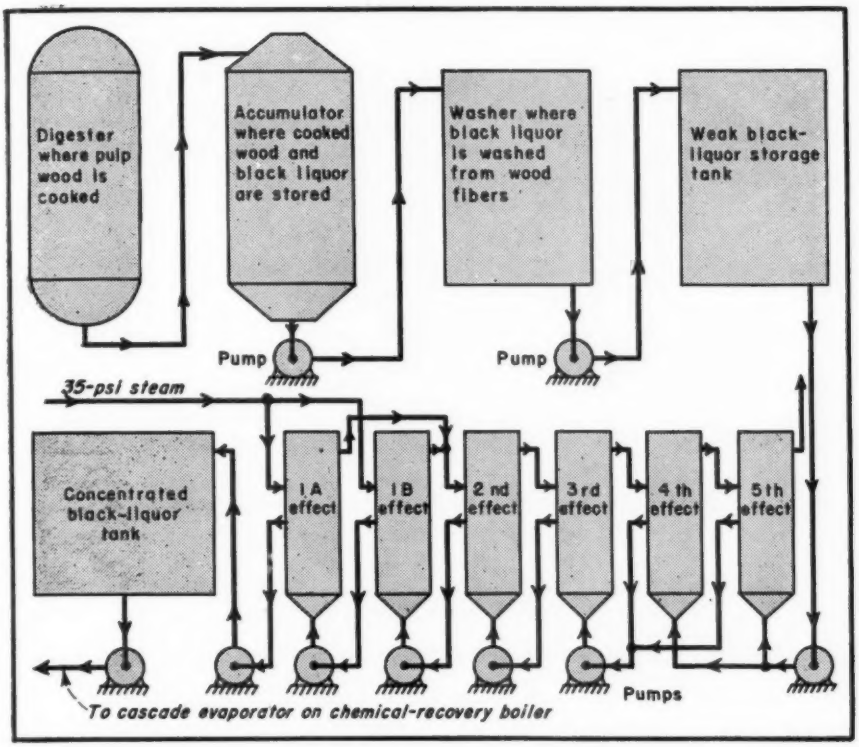

Fig. 6—Black liquor flows from digesters through 5-effect evaporator to storage tanks; from here to cascade evaporator and chemical-recovery furnace

the gas stream turned through about 145 deg in the bottom of the secondary furnace before going up through the boiler tubes.

Dampers in the bridgewall duct and windbox entrance give control of overfire and underfire air, as required for the kind of fuel burned and firing method. They also give control of furnace pressure to keep at a minimum the cold-air flow coming in through the fuel-feed hole in the furnace roof.

Chemical-Recovery Boiler. A Combustion Engineering chemical-recovery boiler provides the third and most important source of byproduct steam. It has 22,245 sq ft of heating surface and is rated 106,000 lb of steam per hour at 175 psi and 450-F total temperature. Before studying this boiler, let us consider the black liquor, from which the chemicals are recovered for reuse in pulp making, and find out where it comes from.

All sulphate pulp is 100% wood fiber. When wood is cooked in a sodium-sulphate solution in a digester, Fig. 6, all but its fibrous portion is dissolved out into the solution, leaving only the wood fibers intact. When the cooking process is completed the digester's contents are blown into a blow tank or accumulator.

The spent chemical solution and wood fibers are then pumped to washers where the fibers are washed clean with water and recovered, and the diluted solution is pumped to a storage tank. This solution is known as weak black liquor, which is concentrated first in a multiple-effect evaporator from about 15 to 50% solids content, then stored in tanks ready for use by the recovery unit (boiler). Solids in this liquor are about 50% combustible and 50% inert chemicals, a large part of the latter being recovered in the recovery unit's furnace.

Recovery Unit Construction. Fig. 5 is a cross-section of the recovery unit. It consists of a waterwall continuous slag-tap furnace, above which is a vertical watertube boiler with superheater. Outside of the boiler is a steam-heated air heater, a cascade evaporator, a forced- and an induced-draft fan, and other auxiliaries necessary to operate the recovery unit.

From the storage tanks, strong black liquor is pumped into the cascade evaporator, Fig. 7, where it is concentrated to between 60 and 65% solids, by heat from the stack gases. In the evaporator, wheels slowly revolve and move the liquor through the gases to bring the two in intimate contact and obtain a high rate of heat transfer and evaporation. Flue gas enters the evaporator at about 600 F and leaves at below 300.

Black-Liquor Burners. From the evaporator the concentrated liquor at about 180 F flows to the mixing tank where sodium sulphate is added to replace the chemicals lost from the system. The liquor is now heated in the primary heater to 195 F and goes down to the black-liquor pump. This pump discharges through the secondary heater at 180 psi to two steam-atomizing burners on opposite sides of the furnace.

These burners oscillate up and down through an arc of 30 deg to obtain wide disbursement of the fuel in the furnace. This action combined with the opposing fuel jets produces a high state of tur-

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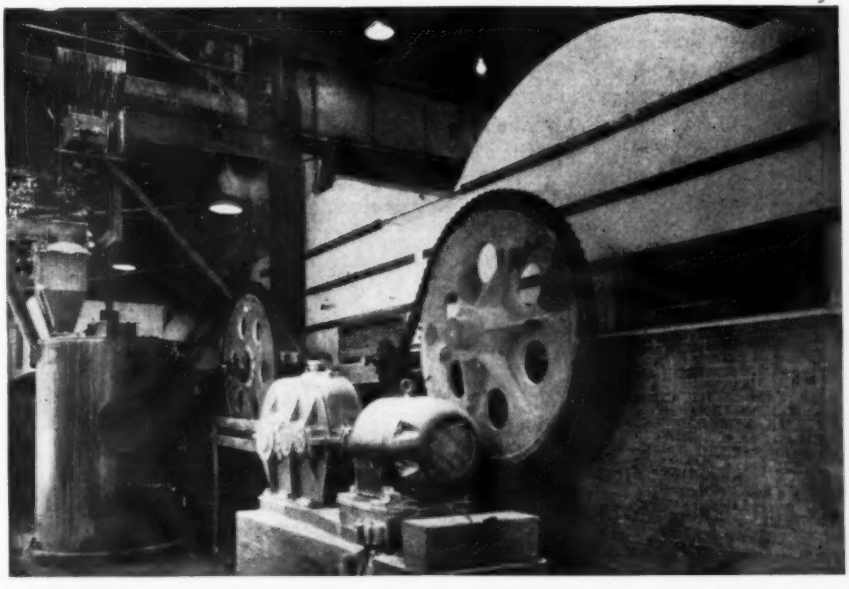


Fig. 7—Cascade evaporator into which the black liquor is pumped from storage tanks, and is concentrated between 60 to 65% solids by heat from stack gases

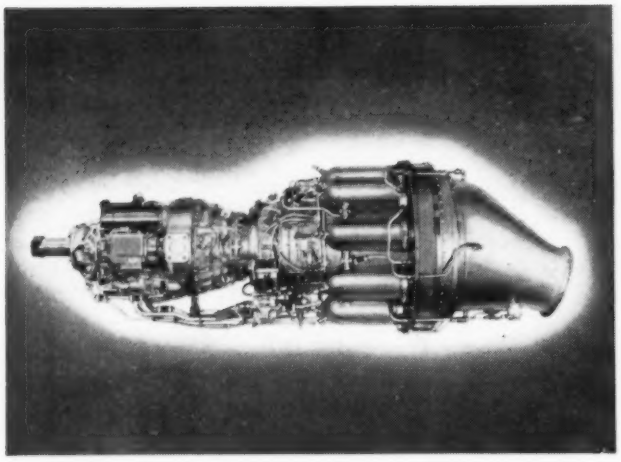


Fig. 1—The type TG-100 gas turbine developed for propeller drive of military aircraft during recent world war

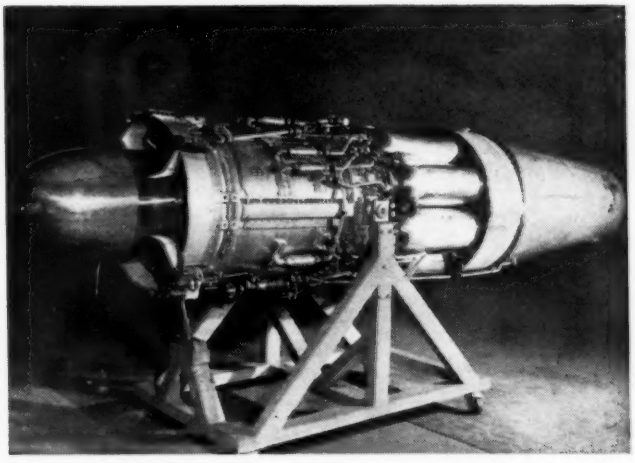


Fig. 2—TG-180 axial-flow jet engine, built to drive planes at high speeds on long flights, exceeds speed of 590 mph

New 4800-Hp 1400-F Gas Turbine

Latest model for railroad propulsion, using high inlet-gas temperature, has only two stages in turbine, no regenerator. Alan Howard, General Electric, describes this unit which may also be applied to industrial power, peak-load plants, etc.[1]

► DEVELOPMENT of gas turbines for locomotive, marine, industrial and central-station applications had been undertaken by the General Electric Co before the war[2]. During the war; it developed several aircraft gas turbines, two of which are shown in Fig. 1 and 2. The first postwar design is the 4800-hp plant for locomotive and other applications shown in Fig. 3.

General arrangement is similar to that of the TG-180 aircraft engine in Fig. 2. This straight-through in-line disposition of components has maximum construction simplicity and minimum pressure loss. Simplicity was particularly desirable for a plant built for long life and heavy fuel. Considering weight, space, and costs of apparatus and fuel it was concluded that neither a regenerator nor other cycle elaboration was justified.

Plant Specification. When running at 6700 rpm with 1400-F turbine-inlet temperature the plant is rated at 4800 hp. Design conditions are 1500-ft altitude and 80-F ambient air temperature. Over-all thermal efficiency referred to the turbine-shaft output is expected to be somewhat above 17%. This figure, which includes allowance for all losses and for auxiliary power consumption, is based on the lower heating value of bunker C fuel.

The 15-stage axial-flow compressor pumps about 70,000 cfm of air through a pressure ratio of about 6:1. Separate wheels, bolted together and carrying the moving blades, make up the compressor rotor.

Six all-metal combustion chambers burn bunker C fuel oil. The 2-stage gas turbine discharges to atmosphere through a diffusing exhaust hood. Ribs between the aft bearing and the turbine casing pass through hollow streamline struts in the exhaust hood, which shield the ribs from the hot gas. The small fan on the turbine shaft draws cooling air over the turbine stator and down through hollow struts.

The power plant forms an integral unit requiring no base. As installed it will drive dc generators through a reduction gear. The base, of girder construction, resembles part of a main frame of a locomotive.

Besides the locomotive application this unit may be applied to such uses as: industrial power, peak-load plants, oil-field power, pipeline power supply, and so on. It is expected that almost any liquid or gas fuel can be used. For some installations steam may be produced from the exhaust-gas energy. Fig. 4 shows an outline of this plant to drive an ac generator.

Preliminary studies reveal this unit may be adapted to a pulverized-coal-burning plant if and when the combustion and ash problems have been solved. Manufacture of identical units in fairly large numbers will reduce costs to a reasonable level. Hence, it is expected these units will be standardized.

With present construction methods larger single-shaft units are expected to present no problem. These may be developed later if they seem justified.

AXIAL-FLOW COMPRESSOR

The separate wheels bolted together, making up the rotor, are held concentric by the fits near the center. There are small gaps between them at the rim to eliminate as far as possible any rotor bending effects caused by possible rubbing or local heating.

The first six stages are of aluminum alloy to reduce weight and rotating inertia. The 13% chrome-steel blading design is based on the vortex principle, with modifications. Some of the blades are machined from bar stock, and others are forged. The bladed wheel in Fig. 5 shows the dovetail arrangement. Each type of blade is used for several stages,

[1] Abstract of paper by Alan Howard, read before the summer meeting of ASME at Chicago, June 18, 1947.
[2] See "The Basic Gas-Turbine Plant," by J K Salisbury, *Mechanical Engineering*, June 1944, pp 373-83.

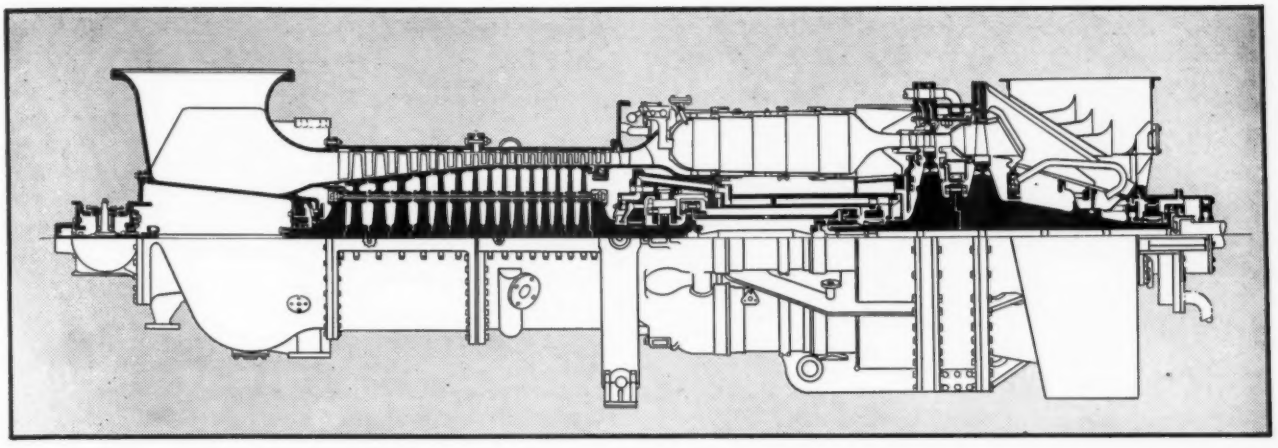


Fig. 3—Gas-turbine plant, running at 6700 rpm with 1400-F turbine-inlet temperature, develops 4800 hp at shaft. The 15-stage axial-flow compressor raises 70,000 cfm air through pressure ratio of 6:1; no intercooling or reheating is used

Marked by Simplicity of Design

with the length cut to suit stage sizes.

This built-up rotor construction simulates that employed successfully in the TG-100 and TG-180. But the present construction is considerably more rugged and somewhat heavier.

Front and back halves bolted together comprise the casing, Fig. 6. A nonsplit ring in the joint minimizes distortions under transient conditions. The inlet half is aluminum, while the discharge end is steel because of the higher temperature. Though the casing is split on the horizontal, neither the aluminum inlet hood nor the steel "midframe," to which the casing is bolted, is split. This results in less distortion under changing conditions.

An extraction point provides cooling air for the turbine wheel. No extraction for starting or other operating conditions is expected to be needed.

With the disk construction of the rotor, relatively high blade speeds can be used with conservative wheel stresses. Therefore, there are a relatively small number of stages, which results in a compact plant.

COMBUSTION CHAMBERS

Six all-metal combustion chambers have an outer casing of carbon steel and inner liners of stainless material. Each liner is about 35 in. long and 10 in. in diameter.

Air enters the inner liner through annular slits between sections and radial holes as well as through louvers. With proper location of these openings excellent combustion conditions prevail over a wide load range, with good stability and ignition characteristics and with good cooling of the liner.

After factory testing it is expected that the combustion system of this first unit will need more frequent scheduled inspection and possible replacement of some parts than will be the case after still further unit development.

Fuel nozzles of the air-atomizing type obtain their air from a small compressor driven from one of the pads of the accessory case at the unit's front end.

Spark plugs in two of the six combustors provide ignition. When these two chambers are fired the others ignite through cross-ignition tubes interconnecting the chambers at the forward end. It is planned to start the unit on diesel fuel and cut over to bunker C oil as idling speed is reached. It may prove feasible to start directly with the heavy oil. This fuel will be preheated from 200 to 300 F, and cleaned by centrifuging or filtering.

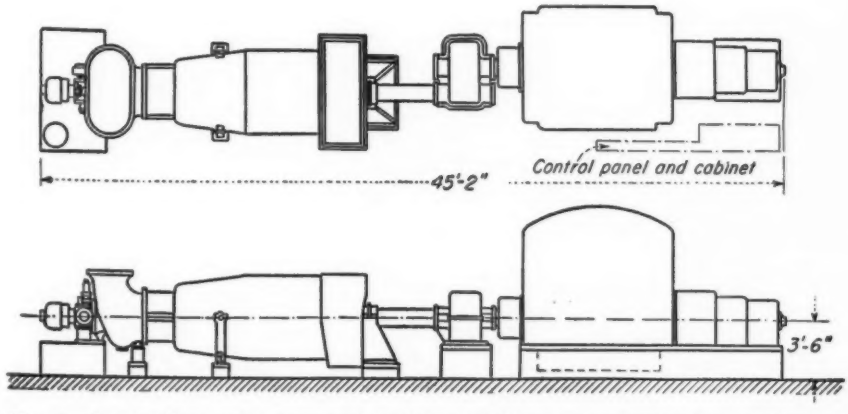


Fig. 4—Gas-turbine unit, arranged to drive 3500-kw ac generator for stationary power applications. Plant can use coal firing when the problems are overcome

TURBINE COMPONENT

The turbine has only two stages because (1) design is simplified (2) unit is more compact (3) first-stage bucket temperature is considerably lower than for a multistage design. The calculated pitch-line temperature is only 1160 F, with 1400-F inlet temperature. If there were eight full reaction stages the bucket temperature would be about 1360 F, or 200 F hotter.

In other words, the turbine inlet temperature may be increased substantially for a given permissible bucket tem-

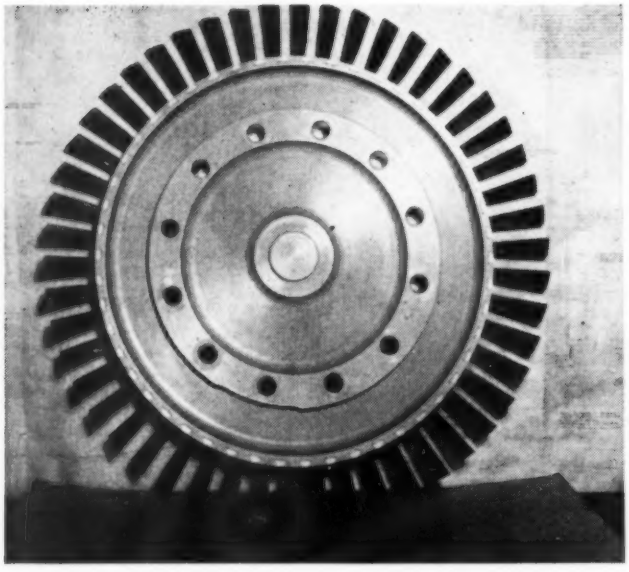


Fig. 5—Compressor wheel for 4th stage with its blades and spacers assembled in place. All wheels making up rotor are held together firmly by through bolts. Wheels are held concentric by fits near the rotor center

perature. This increase is expected to more than offset any possible small reduction in turbine efficiency because of the 2-stage design with impulse first stage.

Decreasing turbine-bucket centrifugal stresses also permits increasing inlet temperature. This is done on the first stage by using a fairly high axial velocity resulting in a shorter, lower stress bucket.

For low leaving losses the exit velocity from the second stage must be relatively small. Thus, there is a considerable step-up in radial height to the second stage. Special care used in the nozzle design assures good performance.

By using a small number of stages the bucket velocity becomes higher than with a multistage design. This increases the wheel stress, which is taken care of by using: (1) rather thick wheels of constant and moderate stress design (2) a composite construction.

The wheel rim is made of stainless material suitable for high-temperature operation, and the main central portion of the wheel is of low-alloy high-strength steel, suitable for operation below 700 F. The rim is welded to the central portion, resulting in a wheel much stronger than one entirely of high-temperature alloy. On the other hand, it is much stronger at the rim than if low-alloy steel only were used. The shaft is forged integral with the wheel center.

To test this construction several sample wheels have been heated by electric induction at the rim with the center remaining cool. After carrying the rim temperature up to 1400 F, several hundred degrees hotter than operating temperature, the whole wheel was then water quenched. One wheel has been put through 100 cycles of this severe treatment and shows no signs of deterioration. Additional tests are continuing, but all indications show this construction will be entirely satisfactory.

Wheel Cooling. Both first- and second-stage wheels are of similar construction and bolted together. Wheels are cooled by a small flow of air bled into the space between them and their adjacent stationary walls. Cooling air is extracted from an intermediate compressor stage. Pipes carry the air across gas path to the packing.

Buckets are fastened to the wheels by dovetails of the axial-entry type. Covers are not used on either stage. Test will determine effect on efficiency and operation of this turbine construction. A higher speed and more compact machine results from the coverless design if root centrifugal stress is limiting.

Shell Construction Rings opposite each wheel provide structural rigidity for the shell. The rings, of ordinary-low-carbon steel, are complete circles with no horizontal split. Stainless steel pieces bolted to these rings form the gas path. These, together with insulating pads, protect the rings from hot gas.

In the turbine casing the expansion is greatly reduced, compared to other designs where the casing is stainless steel and reaches full gas temperature. The exhaust hood, fabricated from low-carbon sheet steel, is being partly protected from corrosion in different ways to determine if such shielding is necessary and, if needed, which method proves best.

The turbine is generally assembled axially except for the second-stage diaphragm and its outer supporting flanged rings, which are split and assembled radially. No other parts of the turbine are split.

CONTROL ACCESSORIES

Accessories are driven from the gear box mounted on the front of the unit. These include a tachometer, overspeed governor, fuel pump, air-atomizing compressor, lubricating-oil pump and fuel regulator.

Machine starting, from a control panel, is partly automatic. Fully automatic starting is anticipated for the future. In a locomotive, starting power would be supplied by a diesel-engine-generator set feeding one of the main generators. Starting power needed depends on the temperature which the plant requires for this condition. The lower the starting temperature, the less severe the temperature shock during starts resulting in increased plant life, but the larger the starting power required. It is estimated that about 100 hp will be needed for satisfactory starting procedure.

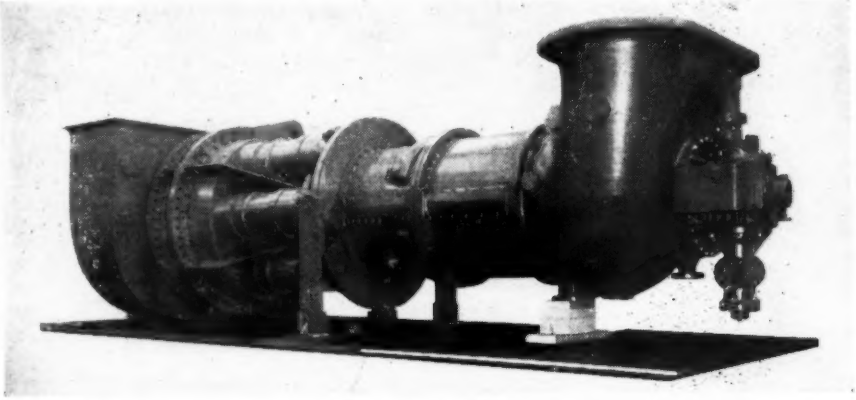
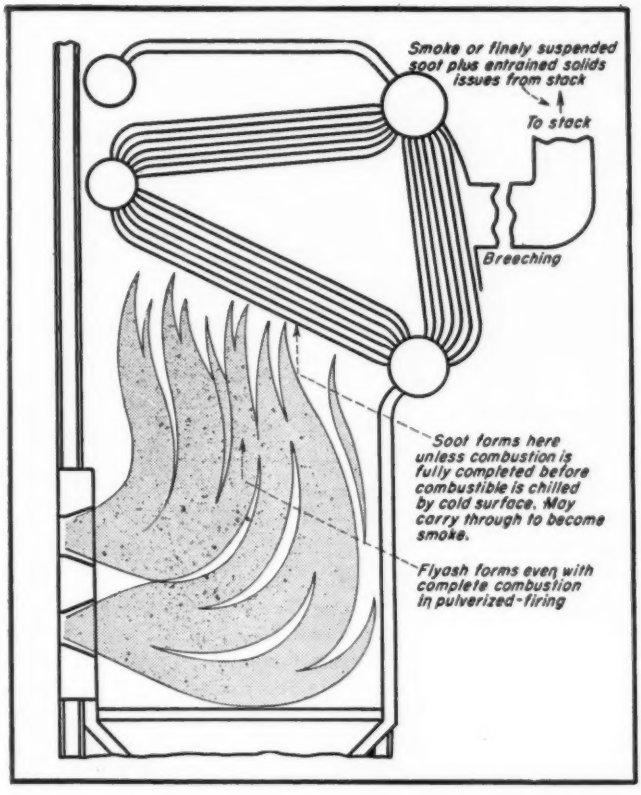
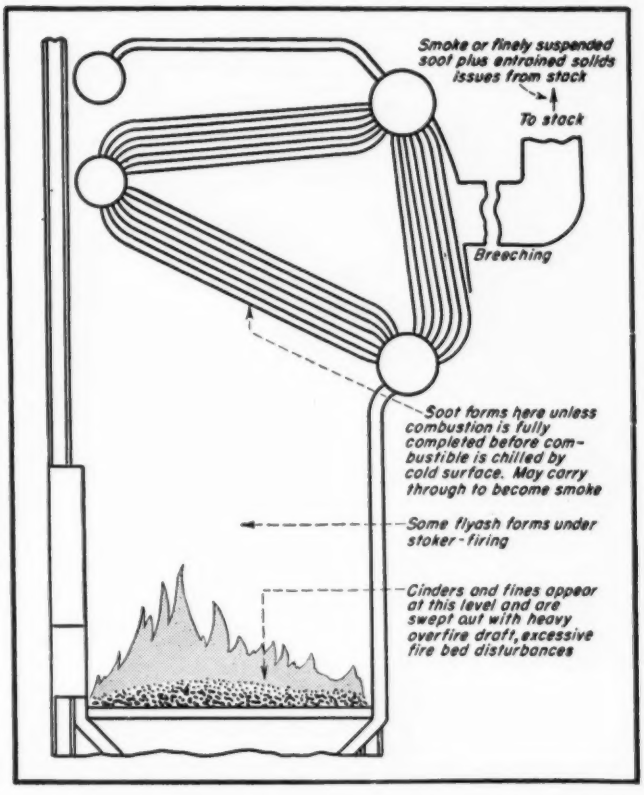


Fig. 6—Full-size wooden mockup of 4800-hp locomotive gas turbine, left to right, exhaust hood, turbine, six combustion chambers, compressor, and the inlet hood


Smoke or finely suspended soot plus entrained solids issues from stock
To stack
Breeching
Soot forms here unless combustion is fully completed before combustible is chilled by cold surface. May carry through to become smoke.
Flyash forms even with complete combustion in pulverized-firing

SUSPENSION FIRING includes gas, oil, pulverized coal. **Sketch shows the major possible sources of air pollution**


Smoke or finely suspended soot plus entrained solids issues from stock
To stack
Breeching
Soot forms here unless combustion is fully completed before combustible is chilled by cold surface. May carry through to become smoke
Some flyash forms under stoker-firing
Cinders and fines appear at this level and are swept out with heavy overfire draft, excessive fire bed disturbances

FUEL-BED FIRING includes manual and mechanical stoking. Smoke and cinder are the most commonly met pollutants

HOW FUEL BURNS

Complete combustion is the prime objective in a campaign for clean plant stacks. Here is a step-by-step review for coal, oil and gas revealing the start of pollution and its remedy

By L N ROWLEY, *Managing Editor*, and J C McCABE, *Assistant Editor*

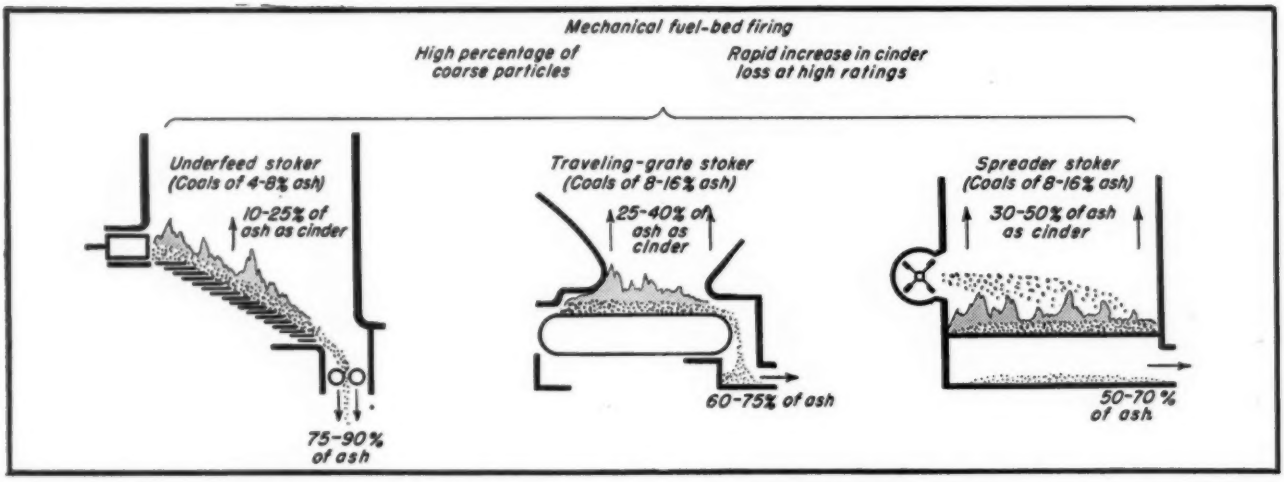
► TAKING A LOOK at the pollution problem, as we did last month, makes it plain that prevention begins at home. The power engineer's first job is to make sure his own stack is clean. Finding out whether it is or isn't presents no difficulties, but if it isn't clean locating the source of trouble may prove somewhat harder. There are several kinds of pollution—smoke, flyash, cinder, fumes—and to trace the trouble back to its source we must know something about them and the way they are formed.

For all practical purposes, power-plant pollution products come from the fuel as it is handled and burned. Let's follow the fuel from storage to stack and see how the various things that happen to it in this process may produce air pollution. For simplicity, we'll confine our investigation to the principal power-plant fuels—coal, oil and gas—ignoring special fuels such as wood waste that require highly individual handling.

Fuel Handling. Storage and handling of oil and gas normally contribute nothing to air pollution, the system being essentially closed. But coal, a solid, requires special consideration. It is always accompanied by fines and dust, the amount depending on the size consist. Moving coal into and out of storage, and from stock piles to the plant, may put some of the fines and dust in the air. Where this nuisance occurs it may be reduced or eliminated by wetting down, or by changes in handling.

Pollution problems really begin when we start to burn fuel. Many prominent smoke-abatement engineers believe that general misunderstanding of the combustion process and its relation to power-plant design and operation stands at the root of most offenses against clean air. A clear understanding of the way fuels burn is thus essential.

Combustion is a special form of oxi-


Mechanical fuel-bed firing
High percentage of coarse particles
Rapid increase in cinder loss at high ratings
Underfeed stoker (Coals of 4-8% ash)
10-25% of ash as cinder
75-90% of ash
Traveling-grate stoker (Coals of 8-16% ash)
25-40% of ash as cinder
60-75% of ash
Spreader stoker (Coals of 8-16% ash)
30-50% of ash as cinder
50-70 % of ash

WHAT HAPPENS TO ASH is indicated in broad terms by sketches of important forms of mechanical fuel-bed firing, showing approximate disposition of ash in typical coals to: (1) the ash pit (2) the gas stream leaving the furnace

dation in which fuel particles and oxygen combine rapidly with liberation of considerable heat. This heat is the power engineer's stock in trade. Clean, troublefree burning produces maximum useful heat and gives off little pollution.

Combustion Mechanics. While combustion is purely a chemical reaction, most problems associated with it are mechanical. Fuel must be prepared for burning, it must be brought into active contact with sufficient amounts of oxygen, and the resulting burning has to take place under conditions that insure completion of the process. Each of these steps—preparation, mixing and burning—depends on mechanical actions and devices.

For a simple example, consider the familiar candle. *No fuel will burn unless or until it is a gas.* The wax won't burn without a wick, which is really a preparation device. If we apply a match flame to a candle without a wick, some wax melts but the limited heat of the match flame proves too small in relation to the amount of wax, and none is brought to the gaseous condition necessary. When a wick is added and a match flame applied, a little melted wax climbs the wick by capillary action. For this small amount of wax, the heat of the match flame is adequate, gasification occurs and the candle burns. The candle flame, once established, provides the heat needed to keep the process going.

With fuels that are naturally in a gaseous state, no preparation is necessary. Here the job is producing the proper mixture of gas and oxygen, and maintaining the conditions necessary for complete burning.

The essential fuel elements are carbon and hydrogen. Sulphur and a few other elements burn but they are not important from a combustion point of view. Both hydrogen and carbon possess high heating values: 61,000 Btu per lb for hydrogen and 14,500 Btu for carbon. These basic fuel elements exist in many combinations called *hydrocarbons*, some of which are normally gases, some liquids, and some solids.

Oxygen Essential. Complete combustion of either hydrogen or carbon requires a definite amount of oxygen. Chemical analysis of the fuel gives the relative amounts of hydrogen and carbon present, and thus indicates the amount of oxygen needed. Oxygen is supplied in the form of air, which contains a known percentage of oxygen, so it is relatively easy to figure how much air is needed for combustion of a certain amount of a given fuel. If exactly the required amount of air is supplied, we have what is called a "perfect" mixture. If too much air is present, we have a "lean" mixture; if too little air, a "rich" mixture. For any gas fuel there is a range of mixtures on either side of the perfect mixture in which the fuel will ignite and continue to burn. We call the limits of this range the *limits of inflammability*.

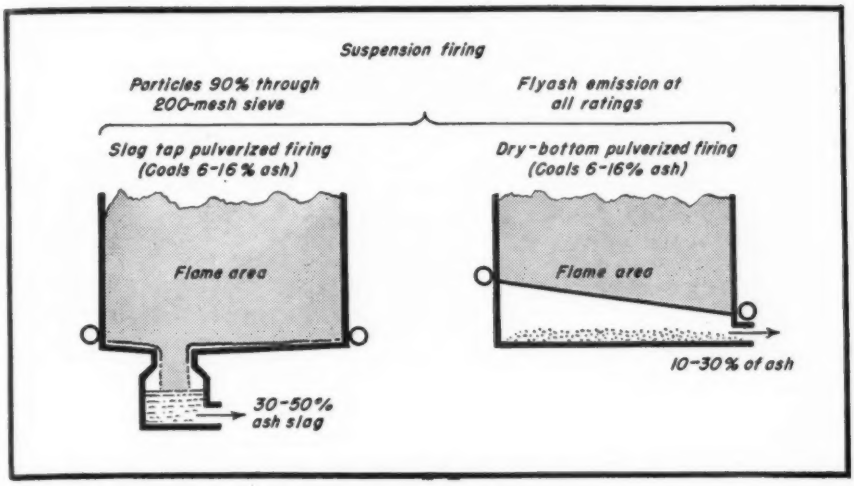
Heat Required. Even a perfect mixture of gas and air will not burn unless a further essential is present—heat. Adding heat accelerates the chemical reaction between the oxygen of the air and the fuel elements. A temperature is soon reached where this chemical combination no longer needs heat from an outside source and combustion is self-sustaining. This is known as the *ignition temperature*. It is at this point that heat liberated by the chemical combination of fuel and oxygen exceeds the heat lost to the surroundings.

Mixing Needed. Producing the correct mixture of fuel and air, and the necessary temperature, in an actual furnace introduces some of the mechanical problems previously mentioned. Let's see what's involved in the question of mixing, for example. Suppose we bring into a furnace the right amounts of gas fuel and air but make no effort to bring about good mixing. In some parts of the furnace we will have a little gas and a lot of air; in others we will have the reverse. Thus in some parts of the furnace the fuel may not even start to burn, while in others it will start but burning will not be complete.

Even with good mixing, the relative proportions of gas and air vary from one part of the furnace to another, and for this reason actual furnaces are supplied with more air than theoretically required. This *excess air* insures that, even though air-fuel ratio varies from place to place, there is no serious deficiency of air.

In furnaces, when a gas fuel mixed with air undergoes the rapid heating characteristic of combustion, the gas "cracks" chemically. Carbon formerly associated in chemical compounds becomes free particles. They glow to incandescence and make the flame visible. Each carbon particle is surrounded by a microscopic envelope of CO and CO_2, produced by reaction with oxygen in the air. The air stream sweeps away this envelope to expose more carbon until the particle burns completely.

Time Needed. This brings us to another essential of successful combustion —time. All the steps in combustion—bringing air and fuel elements together, raising the mixture to the ignition temperature, sweeping away successive layers of CO and CO_2—take time. No mat-



ASH DISPOSAL in pulverized-coal firing varies with type of furnace bottom. Relative proportions shown are necessarily approximate and indicative only

ter how ideal the mixture and the temperature, if the fuel while it is burning strikes a "cold" body, such as a boiler tube or a furnace wall, the resulting chilling stops the combustion process. The result is the formation of *soot*.

Soot, nearly pure carbon in composition, is like lampblack in character. In general, it is soft, fluffy and somewhat tarry. Some soot is carried out with the flue gas in suspension. Its presence becomes visible only in mass and as such forms *smoke*.

The importance of providing sufficient time for the completion of combustion thus becomes evident. In practical furnace work, mixing and burning take place while fuel and air travel from the burner to the furnace outlet. The time available depends on the distance traveled and the speed. This explains the importance of adequate furnace volume and position of cold surfaces in relation to flame travel, and of means for developing turbulence.

By turbulence we mean a condition in which fuel and air whirl and eddy in irregular paths instead of flowing in straight lines from burner to furnace outlet. This has several beneficial effects: (1) There is an increase in the time in which combustion can occur. (2) Better mixing of fuel and air is produced. (3) Air and fuel move past each other at higher velocity, thus helping to sweep away combustion products and expose fresh surfaces.

The same general principles already discussed apply to burning oil and coal, but since these fuels are less ready for combustion, additional problems arise. With oil, for example, the fuel arrives at the burner as a liquid and must be turned into a gas before it can burn. This requires atomization—that is, the fuel must be broken up into small particles so furnace heat can readily affect the conversion to gas.

Burning Solid Fuel. Coal in its natural state is considerably less ready for combustion; hence, preparation is a more important step in the operation. A further complication arises from the fact that coal, unlike oil or gas, contains substantial amounts of mineral impurities (ash) which do not burn. Coal firing may be divided into two broad classes—fuel-bed and suspension—differing mainly in the method of preparing the fuel for combustion.

Fuel-bed firing proceeds in four steps: (1) Coal is pushed, dropped or thrown into a high-temperature region within the furnace. (2) A part of the coal is distilled off as a combustible gas (mostly hydrocarbons and CO) and burned above the fuel bed in the same manner as any gaseous fuel. (3) Remaining solid carbon (coke) is kept red hot and swept vigorously by air until completely burned. (4) Ash is removed from the furnace zone.

Where can atmospheric pollution develop here? In the first place, burning volatile matter above the fuel bed follows the same general rules as apply to any gas fuel; hence soot forms if combustion is stopped before completion. A new pollution possibility arises from the ash content in the solid fuel.

It is necessary to sweep the fuel bed with relatively high-velocity air, and this air may carry with it fine particles. These may be ash or, more likely, partly burned coal particles. The general name given to these solids is *cinder*, and they usually consist of ash and unburned carbon.

Suspension Firing. If coal is pulverized and introduced into the furnace by a suitable burner, it may be burned in suspension instead of on a fuel bed. In its passage through the furnace, each particle traces a history much like that of coal in a fuel bed. Within a fraction of a second after the furnace heat raises its temperature, each particle gives up its volatile matter.

Enough air enters the furnace through the burner to burn the gas from the distillation of the particles. This primary air carries the coal from pulverizer to furnace. It permits burning the volatiles, quickly and without smoke.

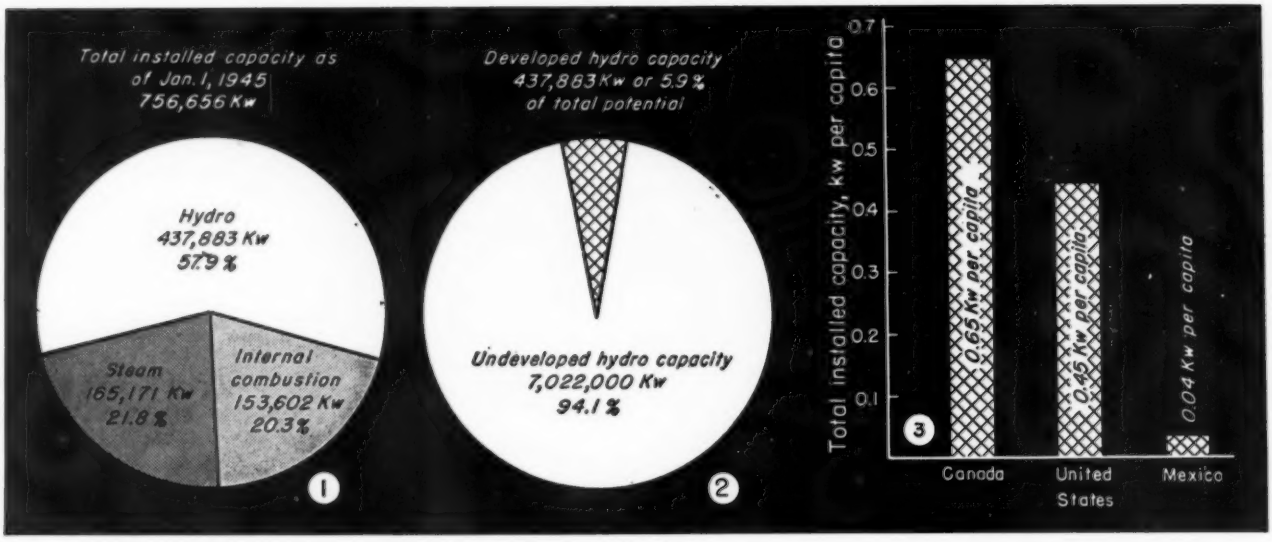
Heat from this combustion process raises the temperature of the entrained solid particles to incandescence. Then secondary air introduced around the burner opening strikes this coal stream, and sweeps past the hot carbon particles to strip the successive layers of CO and CO_2 until combustion is complete.

It can be seen that high air velocities and turbulence are essential to successful pulverized-coal firing. This reduces trouble from poor mixing and chilling so soot and smoke are unlikely to be serious problems, but it tends to carry a high percentage of the ash formed into the gas stream and out of the stack. This *flyash* is a dry powder-like substance, consisting of fine, gray, sharp-edged pieces.

We are now ready to summarize the combustion process and its effect on atmospheric pollution: (1) Complete combustion requires proper preparation of the fuel, intimate and vigorous mixing of fuel and air in the proper proportions, and sufficient time for the process to reach completion. (2) Inadequate mixing or lack of time for completion of combustion causes formation of soot, which, in suspension, causes visible smoke. (3) In the burning of solid fuels, partly burned solid particles (cinder) may be carried out in the gas stream. (4) If fuels contain ash, a certain percentage of it goes out the stack, the amount depending largely on the ash content of the fuel and the furnace design.

Pollution caused by incomplete combustion can usually be eliminated by improvements in equipment and operation and suitable fuel selection, with a resulting gain in plant efficiency. Carry-over of solids, particularly ash, can likewise be reduced, but substantial elimination usually requires some means of removing the particles from flue gas.

Future articles will discuss in detail the various fuels and firing methods, showing the influence of equipment design and plant operation on prevention of pollution, and will also discuss the various means of removing stack dusts.



Reflecting the relative unavailability of coal, steam-electric stations are a minor part of total capacity

Only a small part of hydraulic capacity has been developed although topography is favorable. See map, page 77

Mexico has lagged far behind her two northern neighbors in providing power for her own industry and needs

Mexico Pushes Power Development To Raise Her Standard of Living

With the lowest installed kilowatt of capacity per capita of the three principal countries in North America, Mexico acts to improve her condition. Here's a quick picture of power-generating facilities available, under construction and projected

► Mexico City: Early development of electrical generating capacity in Mexico was entirely the work of private enterprise, in large part of foreign origin—American and English. This activity gradually decreased because of the socialization tendency then penetrating the country's political thinking.

In 1936, when President Cardenas took over, there was already considerable shortage of electrical power. Since private industry was reluctant to invest money, the government took steps to increase power-producing facilities. On August 14, 1937 a government agency, Federal Electricity Commission, was empowered to build and operate electrical plants as well as transmission and distribution systems.

The commission's revenues, however, are too small to support an extensive and rapid program of development. Its funds derive from a 10% tax on all electricity bills and the floating of 6% ten-year loans, Electric Industry Bonds. The tax brings in about 10,000,000 pesos ($2,000,000) a year, totaling about 51,300,000 pesos since it went into effect in 1939. Bond subscriptions brought an additional 10,000,000 pesos.

Building Programs. The commission has built 28 plants. The largest is the Ixtapantongo hydro station now operating with one 40,000-hp unit under a head of 1075 ft, Fig. 4 and 5. This is one of the highest-head reaction turbines in the world, see Power, March 1946, pp 90-1. The station is designed to house ultimately three machines of 85,000-kw total capacity.

During recent political regimes private industry felt more secure and various private companies built new plants and enlarged existing ones. The Mexican Light and Power Co, for instance, increased the capacity of its Nonoalco plant, near Mexico City, from 30,000 to 55,000 kw. Total national capacity as of Jan 1, 1945, with its distribution as to type, is shown in Fig. 1. Relative scarcity of coal, Fig. 6, accounts for the few steam installations; only about one-fifth of the total capacity. Coal's greatest importance lies in developing the steel and iron industry.

Though the total flow of the rivers of Mexico is roughly equivalent to the sum of that in the Colorado, Sacramento and San Joaquin rivers of the U. S. A., the topography favors the development of considerable hydraulic capacity. At present, only a small part of the potential capacity has been developed, Fig. 2. For power generation alone some of these potential sites are uneconomical to develop, but when considered jointly with irrigation where needed they become highly desirable regardless of erection costs. Present electric generation is highly dependent on hydro production, Fig. 1. For lo-

Fig. 4—Ixtapantongo hydroelectric plant of the Federal Electricity Commission uses some of the highest-head reaction turbines in the world. Penstocks at plant rear

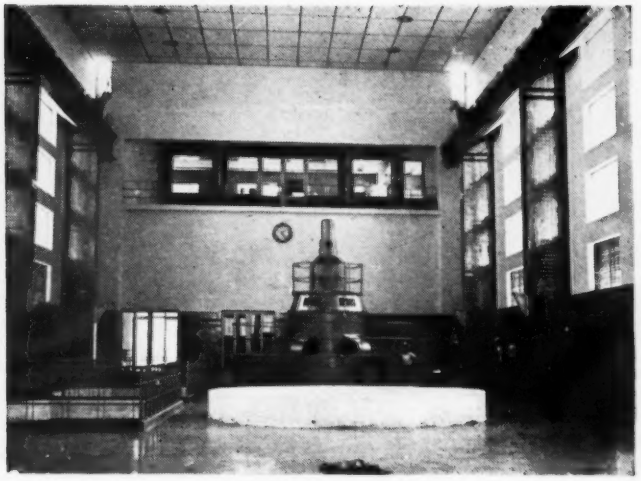


Fig. 5—Generator room of Ixtapantongo hydroelectric plant. First 28,000-kw 600-rpm unit in background, and base for second unit under construction in foreground

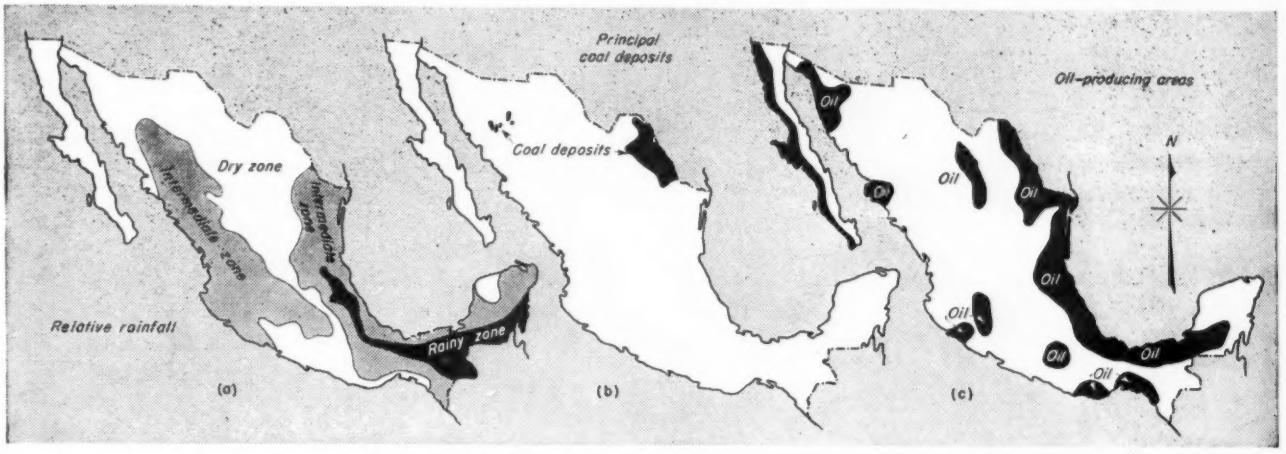


Fig. 6—Distribution of Mexico's energy sources (a) water (b) coal (c) oil. In the dry zones agriculture cannot be pursued without irrigation; in the intermediate zones some supplementary irrigation is needed. Maximum benefits are expected sometimes by combining irrigation and hydroelectric projects. Coal deposits have not been fully explored, are of major importance in developing steel industry. Large area of oil deposits makes this the most important fuel source in Mexico and oil finds utilization in most steam plants as well as internal-combustion engines

cation of present plants and potential sites, see the large map on p 76.

Mexico has large oil reserves, Fig. 6. In the early 1920s annual production approached 200,000,000 barrels. Since then annual output has decreased rapidly until it now stands at less than 50,000,000 barrels. About 80% of this is used within Mexico itself. Estimates show that if annual production should again reach 200,000,000 barrels the reserves in sight should last at least 100 years. Considerable utilization of natural gas associated with the oil is anticipated.

Most generating facilities are concentrated in central Mexico, in the states of Mexico, Guadalajara, Puebla and Veracruz, which have the major part of its industries. The various systems at each of these locations are largely interconnected.

Electric service types are distributed about as follows.

	%
Direct current	1.6
Alternating current, 60-cycle	55.4
Alternating current, 50-cycle	41.6
Alternating current, 42-cycle	0.5
Alternating current, 25-cycle	0.9
Total	100.0

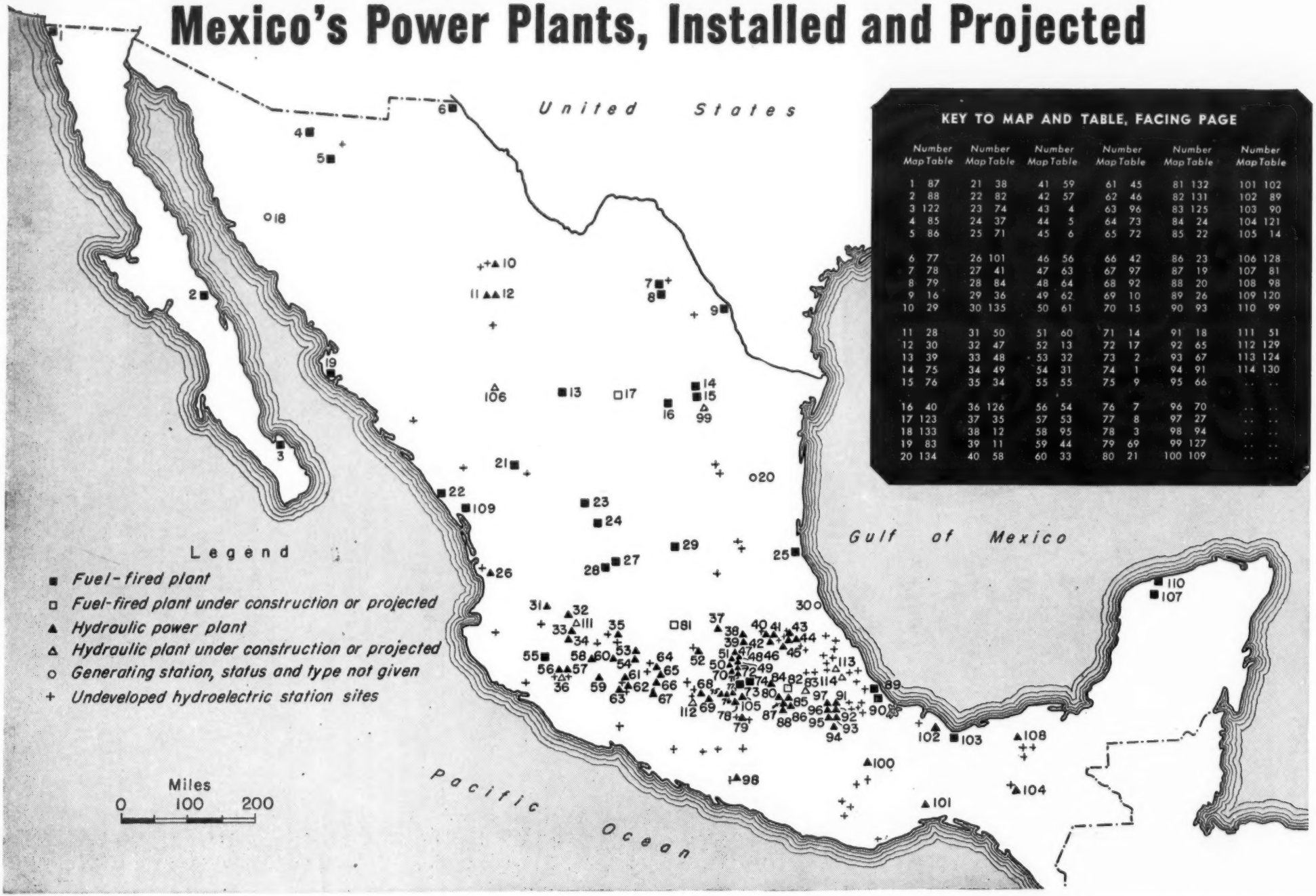
New Capacity. Total capacity under construction since 1945, some of which is now in operation, adds to 178,545 kw. Of this amount, the Federal Electricity Commission is installing 81,785 kw, the largest unit being the second 28,000-kw hydro-turbine-generator set for Ixtapantongo. Privately owned utilities and various industries are installing the remaining 96,760 kw.

There are 13 projects in the federal program and 21 in privately owned enterprises, all of which are expected to be completed shortly.

From 1947 through 1949 a total of 327,340 kw in new capacity is projected. The federal commission is planning 295,340 kw, and private industry the remaining 32.000 kw. When completed, this program will represent a 35% increase in the nation's power-generating capacity.

Mexico's electrification program aims to promote and develop new agricultural and industrial centers by providing new generating plants and extending transmission facilities of existing systems. Also, extensions are being made to existing stations and systems to satisfy urgent demands for increased energy supply. As in the U.S.A., the next few years will witness a record-breaking growth of the electrical industry in all parts of Mexico.

Mexico's Power Plants, Installed and Projected



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Number Map	Table	Number Map	Table	Number Map	Table	Number Map	Table	Number Map	Table	Number Map	Table
1	87	21	38	41	59	61	45	81	132	101	102
2	88	22	82	42	57	62	46	82	131	102	89
3	122	23	74	43	4	63	96	83	125	103	90
4	85	24	37	44	5	64	73	84	24	104	121
5	86	25	71	45	6	65	72	85	22	105	14
6	77	26	101	46	56	66	42	86	23	106	128
7	78	27	41	47	63	67	97	87	19	107	81
8	79	28	84	48	64	68	92	88	20	108	98
9	16	29	36	49	62	69	10	89	26	109	120
10	29	30	135	50	61	70	15	90	93	110	99
11	28	31	50	51	60	71	14	91	18	111	51
12	30	32	47	52	13	72	17	92	65	112	129
13	39	33	48	53	32	73	2	93	67	113	124
14	75	34	49	54	31	74	1	94	91	114	130
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16	40	36	126	56	54	76	7	96	70	..	..
17	123	37	35	57	53	77	8	97	27	..	..
18	133	38	12	58	95	78	3	98	94	..	..
19	83	39	11	59	44	79	69	99	127	..	..
20	134	40	58	60	33	80	21	100	109	..	..

Generating Stations in Mexico

Number Table	Map	Company	Plant	Station Data*
1	74	Cia Mex de Luz y Fza Mtz, SA	Nonoalco	3- 55,000-F-50
2	73		Olivar	2- 2,240-F-50
3	78		Alameda	3- 8,800-H-50
4	43		Necaxa	9-90,000-H-50
5	44		Tepeji	3-45,000-H-50
6	45		Texcapa	2- 5,370-H-50
7	76	Cia Luz y Fza Elect Toluca, SA	S Simon	2- 2,540-H-50
8	77		Zictepec	1- 400-H-50
9	75		Zepayautla	1- 700-H-50
10	69		Temascaltepec	4- 2,100-H-50
11	39	Cia Luz y Fza de Pachuca, SA	Juando	2- 3,600-H-50
12	38		Canada	1- 1,200-H-50
13	52	Cia Fza Suroeste de Mexico, SA	Tepuxtepec	2-48,000-H-50
14	105	Cia Meridional de Fuerza, SA	El Aguila	2- 300-H-50
15	70	Cia Mex Luz Electrica, SA	Villada	1- 1,200-H-50
16	9		Fdez Leal	1- 1,400-H-50
17	72		Tlilan	1- 800-H-50
18	91	Cia Tranv L y Fza de Puebla, SA	Tuxpango	4-36,000-H-60
19	87		Portezuelo I	4- 3,170-H-60
20	88		Portezuelo II	2- 1,850-H-60
21	80		Sn Agustin	4- 960-H-60
22	85	Cia Electrica Mexicana, SA	Carmela	2- 800-H-60
23	86		Carmelita	2- 500-H-60
24	84		Ventanas	1- 240-H-60
25	—		Concepcion	1- 168 — 60
26	89	Cia Ltd Fza y Traccion Veracruz	Veracruz	4- 1,200-F-60
27	97	Cia Luz y Fza Mtz Orizaba	Ixtaczoaquitlan	4- 1,600-H-60
28	11	Cia Agr y de Fza Elect Rio Conchos	Boquilla	4-27,600-H-60
29	10		Rosetilla	2- 9,690-H-60
30	12		Colina	1- 3,200-H-60
31	54	The Michoacan Power Co	Botello	2- 8,600-H-60
32	53		Sabino	2- 4,200-H-60
33	60	The Gto Power and Electric Co	Platanal	3- 7,000-H-60
34	35	Cia Hidr Guanajuatense, SA	Sn Francisco	2- 260-H-50
35	37	Cia Hidr Queretana, SA	Las Rosas	4- 1,300-H-60
36	29	Cia Nac de Elect Div Sn Luis	S Luis Potosi	3-16,500-F-60
37	24	Cia Nac de Elect Div Zacatecas	Zacatecas	5- 975-F-60
38	21	Cia Nac de Elect Div Durango	Durango	6- 2,755-F-60
39	13	Cia Nac de Elect Div Torreon	Francke	3-29,830-F-60
40	16	Cia Nac de Elect Div Saltillo	Saltillo	7- 4,700-F-60
41	27	Cia Nac de Elect Div Agstes	Aquascalientes	5- 5,380-F-60
42	66	Cia Electrica Morelia, SA	Sn Pedro	3- 1,448-H-50
43	—		Cointzio	1- 480 — 50
44	59		Itzicuaro	2- 552-H-60
45	61		Sn Juan	2- 240-H-50
46	62	Cia Electrica Morelia, SA	Sn Pedro	2- 392-H-50
47	32	Cia Electrica Chapala, SA	Las Juntas	4-13,400-H-60
48	33		Puente Grande	4-14,400-H-60
49	34		El Salto	2- 1,000-H-60
50	31		Potrero	2- 287-H-50
51	111		Colimilla	4-54,000-H-60
52	—	Cia Hidr Occidental, SA	El Remate	1- 450-H-60
53	57	Cia Electrica Guzman, SA	Antigua	2- 287-H-60
54	56		Nueva	1- 360-H-60
55	55		Sayula	2- 226-H-60
56	46	Cia Transm Elect Pot Edo Hgo	Trinidad	3- 1,440-H-50
57	42		Coacoyunga	1- 3,200-H-50
58	40		Regla	1- 720-H-50
59	41		S Sebastian	3- 960-H-50
60	51	Schmels Hermanos	Sn Luis	2- 512-H-50
61	50		Macavaca	1- 352-H-50
62	49		Taximay	1- 176-H-50
63	47		Jasso	1- 920-H-50
64	48		Tepeji del Rio	1- 148-H-50
65	92	Cia Ind de Orizaba	Rincon Gde	4- 3,632-H-25
66	95		Coclapa	2- 1,500-H-25
67	93		Boqueron	1- 1,155-H-25
68	—		Rio Blanco	1- 125 — —
69	79	Cia Hidr del Amacuzac, SA	Barranca Honda	2- 3,120-H-50
70	96	Cerveceria Moctezuma, SA	Metlac	2- 4,000-H-60
71	25	Cia Electrica de Tampico, SA	Andonegui	3-18,000-F-60
72	65	Emp L y Fza Hidr La Trinidad	Trinidad Tirio	4- 1,312-H-50
73	64		Trinidad Morelia	1- 604-H-50
74	23	The Fresnillo and Electric Co	Fresnillo	5-12,261-F-60
75	14	Cia Tranv L y Fza Monterrey	Bellavista	1-18,000-F-60
76	15		Allende	2- 8,000-F-60
77	6	Cia Nal Prod L y Fza Mtz	C Juarez	1- 1,828-F-60
78	7	Cia Carbonifera de Sabinas, SA	Nva Rosita	3- 6,000-F-60
79	8	Cia de Combust de Agujita	Agujita	3- 1,134-F-60
80	9	Junta Fed Mej Materiales	A Obregon	6- 2,104-F-60
81	107	Cia Electrica de Merida, SA	Merida	5- 7,000-F-60
82	22	Abast Luz Fza y Agua	Mazatlan	6- 2,572-F-60
83	19	United Sugar Co	Los Mochis	5- 2,749-F-60
84	28	F F C C Nac M Lineas Admtds	Aguascalientes	3- 1,100-F-60
85	4	The Cananea Consolidated Co	Cananea	5- 9,980-F-60
86	5	The Moctezuma Copper Co	Nacozari	6- 5,808-F-60
87	1	Cia Elec y Telef Fronteriza, SA	Tiajuana	4- 1,771-F-60
88	2	Cia de El Boleo, SA	Sta Rosalia	2- 3,840-F-60
89	102	Cia Hid Minatitlan, S C de R L	Guazuntlan	1- 1,600-H-60
90	103		Pto Mexico	5- 1,570-F-50
91	94	Cia Industrial Veracruzano, SA	Zoquitlan	2- 1,500-H-60
92	68	Comision Fed de Electricidad	Ixtapantongo	1-28,000-H-50
93	90		Veracruz	3-10,500-F-60
94	98		Colotlipa	1- 2,000-H-50
95	58		Granados	1- 940-H-60
96	63		Zumpimito	1- 800-H-60
97	67		Bartolinas	2- 670-H-60
98	108		Villahermosa	3- 600-H-50
99	110		Progreso	2- 600 — 60
100	—		Palmira	1- 249 — 50
101	26		Jumatan	1- 220-H-60
102	101		Ixteped	1- 164-H-60
103	—		El Refugio	1- 160 — 50
104	—		Sta Juana	1- 120 — 50
105	—		Acatzingo	2- 104 — 60
106	—		Tlacoltalpan	1- 104 — 60
107	—		Ures	1- 100 — 60
108	—		Altar	1- 100 — 60
109	100		Xia	1- 85-H-50
110	—		Caracuaro	1- 80 — 60
111	—		Plantillas	1- 68 — 50
112	—		Mazamitla	1- 43 — 60
113	—		Suchiate	1- 40 — 60
114	—		Concordia	1- 40 — 50
115	—		Villa Victoria	1- 30 — 50
116	—		Cuauhtemoc	1- 21 — 60
117	—		Alamos	1- 16 — 50
118	—		Coyuca	1- 15 — 50
119	—		Janitzio	1- 5 — 60
120	109		Rosario	225 — 60
121	104		Bombana	4- 980-H-60
122	3		La Paz	— 600-F-60
123	17		La Laguna	2-25,000-F-60
124	113		El Encanto	10,000-H-60
125	83		Valsequillo	2- 5,500-H-60
126	39		Tonilta	2- 4,000-H-60
127	99		Cola de Caballo	1- 1,000-H-60
128	106		El Palmito	3-10,000-H-60
129	112		Santa Barbara	2-23,000-H-60
130	114		Minas	2- 4,800-H-60
131	82	Cia Electrica Mexicana, SA	Puebla	1- 9,000-F-60
132	81	Cia Hidr Guanajuatense, SA	Celaya	1- 9,000-F-60
133	18	Mexican States Pub Service Co	Hermosillo	— Small — 60
134	20	.....	Ciudad Victoria	— Small — 60
135	30	.....	Tuxpan	— Small — 60

*Under the head "Station Data," the four columns from left to right show (1) No. of units, (2) Total capacity, kw, (3) Type, F for fuel-fired and H for hydro, (4) Cycles.

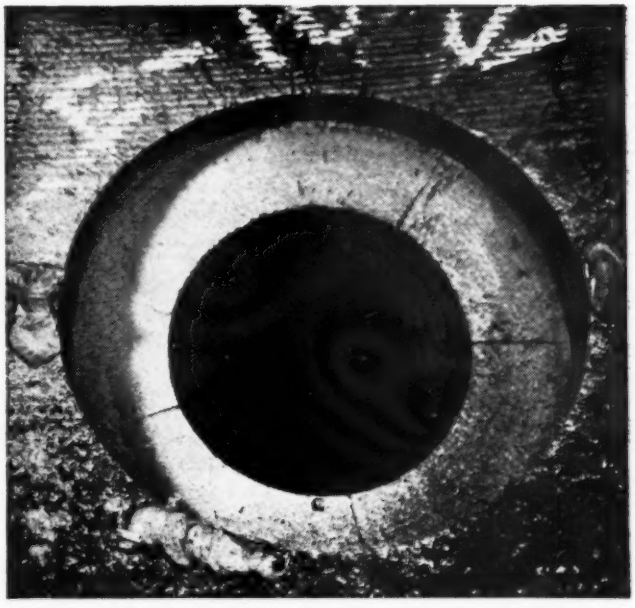

Fig. 1 and 2—Investigation disclosed that the cracks definitely resulted from corrosive fatigue rather than caustic embrittlement. Undoubtedly they were caused by pure condensate remaining in contact with boiler metal

Gage-Glass Condensate Cracks Metal By Pocketing at Drum Counterbore

One plant licked 'corrosive fatigue' by revamping drum connections. Thus returning condensate diffused into boiler water instead of remaining undiluted in the counterbore where it had caused cracking

By J A KEETH

Manager of Power Production
Kansas City Power & Light Co

▶ EQUIPMENT that has operated for years without trouble may suddenly develop marked and serious corrosion. Faced with such a problem, power-plant engineers sometimes find it difficult to associate the occurrence with any change in the operating cycle or equipment. But thorough investigation usually uncovers a clue which, if exhaustively followed, explains the trouble.

Corrosive Fatigue. One type of failure, which an inexperienced observer may not associate with corrosion, is the cracking of heavy boiler drums at the lower water-column connection and feed-line entrance. The cracks are seldom accompanied by visible corrosion; nevertheless they result from the combined action of high stress and a corrosive agent. In this instance, temperature change produces the high stress; the corrosive agent is pure water or condensate with a low pH value. Such cracking, called "corrosive fatigue," is almost invariably found at points of high-stress concentration or at points of cyclic stresses in the presence of some corrosive agent.

Until the introduction of high pressures demanded thick-walled boiler drums, trouble did not appear at lower water-column connections and feed-line entrances except in rare cases. In today's thick-walled drums, the water-column tube connections are usually rolled into the outer portion of deeply counterbored holes. The feed-line connection being much larger is usually studded to the drum's outside surface.

In the water-column connection, pure condensate (condensed steam in gage glass and column) returns to the boiler drum through the lower line and flows over the drum metal at the tube counterbore. The condensate may be from 100 to 300 F cooler than water in the drum or the drum metal. Similarly, depending on the heating cycle, relatively pure feedwater flowing over the drum metal at the entrance hole may be considerably cooler than the adjacent metal itself.

This cooling of the drum metal surface, by contact with entering condensate or feedwater, sets up high stresses in the metal at a point where the pH value of the contact water may be low. The result, usually not long delayed, is a crack or series of cracks at the sharp edges of the hole. If the cause is not eliminated, and the cracks are not checked, they may become sufficiently serious to cause failure.

Effect on Boiler Drums. One instance of such corrosion occurred in the main steam drum of two 1400-psi boilers with forged-steel drums. The lower water-column connection passed into the drum radially on the lower side at

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* Abstract of a paper delivered at meeting of the National Association of Corrosion Engineers, in Kansas City, Mo., May 1946.

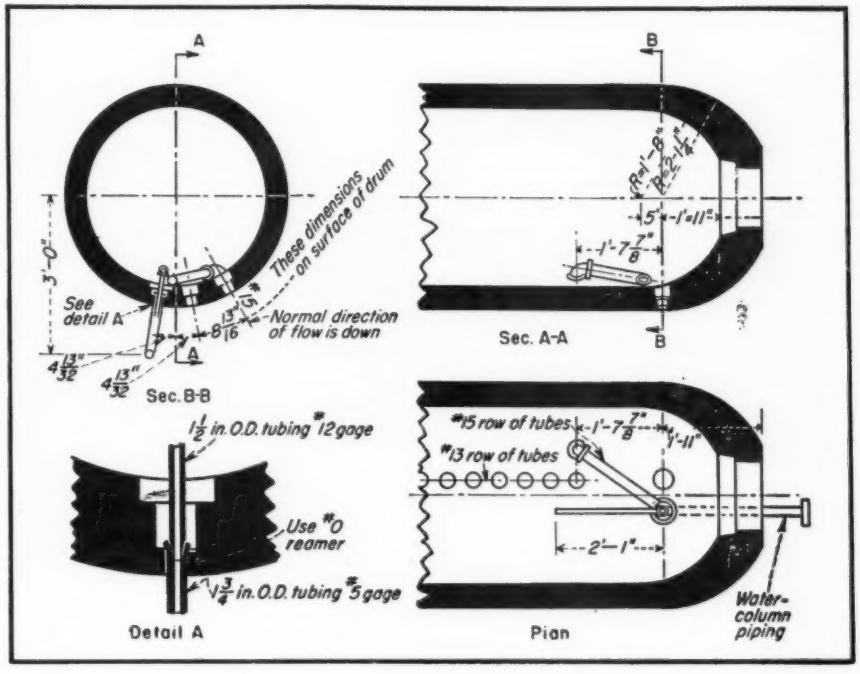


Fig. 3—After repairing the counterbores, water-column lines were extended into the drum. Another change made water in counterbore circulate to tubes

a point near each end. The connection consisted of 1¾ in. OD No. 5 gage tubing, expanded into a counterbored hole, the rolled part of the tube being about 1¼ in. long. Inside counterbore left a fairly large pocket at the connection. The total drum thickness is 5¼ in. Counterbore is 2⅜-in. in diameter, adjacent to the tube roll, and 4 in. at the inner drum surface.

Corrosive fatigue appeared distinctly as cracks radiating across the face of the stepoff section, and also at the rim of the large counterbore that extended out into the drum, Fig. 1 and 2. Fig. 1 shows the start of a sawcut to remove a V-shaped piece of metal to be used for microscopic analysis. Another sawcut was made to include the crack shown in the photograph. Investigation of this attack disclosed that the cracks were transcrystalline and, therefore, not in the category of caustic embrittlement. They were definitely of a corrosion-fatigue nature, and undoubtedly the result of pure condensate coming back from the water columns and remaining in the large counterbores in contact with the drum metal.

Condensed steam, returned from the water columns, had a low pH value (6.9 to 7.3) and, therefore, was corrosive. The tube holes were in the drum ends beyond the point of circulation so little if any dilution with boiler water occurred. Tests also showed that temperature of water returned from the water columns was about 250 F lower than water in the drum, and hence in the main body of the drum metal. This difference probably set up temperature strains at the sharp edges of the counterbores, which together with the corrosive water caused the cracks.

Defects Corrected. The trouble was corrected by eliminating all trace of cracks by boring with a rig set up inside the drums. The counterbores were enlarged and stepped off as required; at the same time, as much of the drum metal as possible was conserved. Next, the lower water-column connections were brought entirely through the drum wall and into a portion of the boiler where active circulation existed. The pipe was extended with a water-tight tapered joint, which did not in any way affect the tightness of the rolled joint. Fig 3. In addition to carrying the water-column discharge over into the active boiler circulation (boiler-water pH 9.5 to 10.0) water from the tube-hole counterbore was made to flow over to one of the main boiler tubes in which normal flow was definitely downward, thus putting the water in that cavity into active circulation. The cure is effective, as no further cracking has appeared in several years.

Precautions Taken. Cracking had not occurred at the feedwater entrance. Temperature difference at this point was not over 100 F, which, together with a higher pH of the water (8.0 to 8.5), probably delayed the action. Having learned by experience with the water-column connections that the feedline holes were subject to similar attack, steps were taken to prevent trouble in the future.

Protective measure consisted of using a so-called "thermal sleeve" to keep the incoming feedwater out of contact with the drum metal. The thin sleeve carries the water through the drum to the inside distributing system and leaves an annular space between it and the drum. This space was open on the inside of the drum for entrance of boiler water at about the same temperature as the drum and also of a noncorrosive nature (pH 9.5 to 10.0). The thermal sleeve, therefore, eliminated temperature stress as well as the corrosive agent. This type of feedwater admission to heavy boiler drums is almost universal in all new construction today.

Many other pieces of power-plant equipment are subject to corrosion fatigue but in general the remedy is the same: Eliminate the high or cyclic stresses and eliminate the corrosive agent. While equipment might give reasonable life with either condition alone, depending upon materials and severity of stress and corrosive action, a combination of the two calls for action to prevent costly replacements and possibly disastrous failures.

Furnace Explosions

IN SPITE OF THE EFFORTS of equipment manufacturers, insurance companies and other interested groups to instill in the minds of boiler operators the need for care, preventable furnace explosions continue to happen.

Many accidents could be avoided by observing one simple precaution—never introduce a flame into a furnace unless it is known to have been ventilated for a reasonable time. "Reasonable" is an elastic word here since the length of time depends on many factors, such as type of fuel, furnace size and provisions for ventilating it. In general, an operator should realize he is flirting with danger, and allow time accordingly.

It is easy to become careless because "familiarity breeds contempt." But when dealing with an explosive element, such as a combustible gas in a boiler furnace, it should not be treated carelessly even though no difficulty has been encountered.—*The Locomotive.*

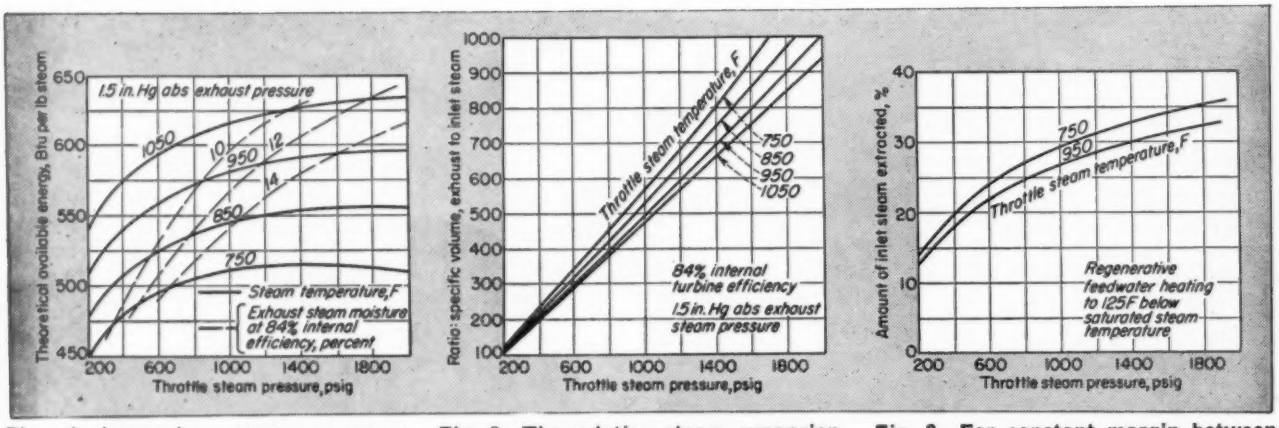


Fig. 1—Increasing steam pressure and temperature raises amount of work one lb of steam can do. Moisture at exhaust limits the pressure

Fig. 2—The relative steam expansion from throttle to exhaust increases directly with increasing steam pressure, decreases for rising temperature

Fig. 3—For constant margin between saturation and feedwater temperature, increasing inlet steam pressure raises need of bleed steam for heating

Large Steam Turbines Attain New

Though central-station prime-mover improvements have followed a continuous upward trend, each feature is proved in service before taking the next step. Here are reviewed the history of rotor speed, exhaust-blade length, steam conditions, the growing acceptance and advantages of large-unit standardization

By C B CAMPBELL, ENGINEERING MANAGER
Steam Turbine Division, Westinghouse Electric Corp

► LITTLE WAS HEARD during the war of steam turbine-generator development for stationary plants despite the indispensable role of this equipment. The major task was to provide propulsion and electrical generating units for an unprecedented number of ships of all types. While this demand was being satisfied, it was possible to produce only those stationary turbines that government agencies found most urgently needed.

With production restrictions removed the demand for large stationary units, 10,000 kw and above, has become enormous. Production, measured in combined kw capacity, will for some time proceed at a rate four times the average for the years 1938 to 1941, inclusive.

Throughout the war, record peak demands were encountered, along with greatly extended high-load demand periods. An uncommonly high degree of continuous operation was required of all generating units. Overhaul schedules were rather generally deferred. Short-time shutdowns were relatively infrequent whereas in normal circumstances they allow sufficient time for many minor maintenance tasks.

Continuous Service. Steam turbines show no evidence of having suffered undue deterioration from operation under these severe conditions. In fact, their outstanding record lends strong support to the conclusion that continuity of service, under intelligent surveillance, is distinctly favorable to the turbine. Intermittent operation, with its attendant extremes of turbine temperature and transient nonuniformity of temperature distribution, is not conducive to best mechanical performance.

Marine Experience. Several million horsepower of ship turbines having been produced, it is pertinent to inquire what effect this experience has had on large stationary turbines. Direct influence is small. Land and marine turbines are based on the same mechanical and thermodynamic principles, but differ in arrangement, construction and control details. Benefit results from certain manufacturing processes developed for volume production of marine turbines. Welding techniques will likely find broader application, not so much to reduce weight as to lessen production delays from extensive repair of steel castings. Nondestructive-material inspection methods will carry over. The power industry will benefit from the standardization which was a factor contributing to the success of the marine-turbine program. Stationary-turbine design, however, will be but little altered by the marine-turbine experience.

Large-turbine design practice has never been static and probably never will be. The point has not been reached where experience with large units in service no longer indicates the way to construction improvements. This is particularly true when it becomes necessary to extrapolate beyond existing experience and then to consolidate the gains accruing from, for example, increases in machine rating at a given rotation speed, elevation of steam pressures and temperatures, and the introduction of new materials and manufacturing processes.

HIGH-SPEED TURBINES

Maximum rating of 3600-rpm condensing turbines has grown rapidly. In 1929 the first 10,000-kw single-casing

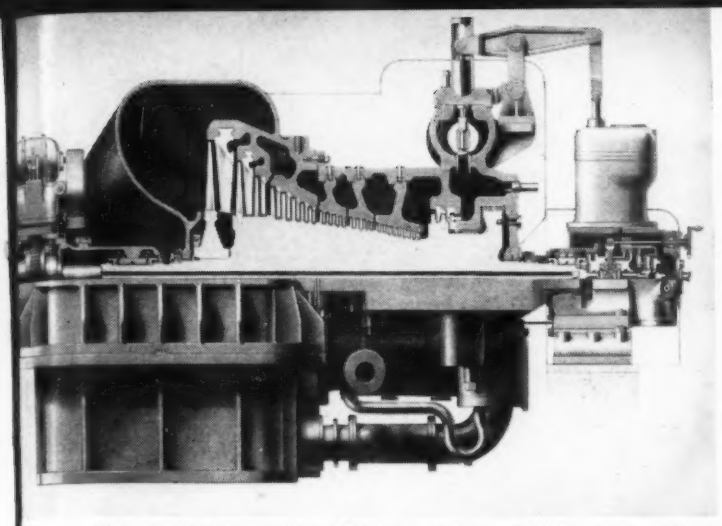


Fig. 4—Single-casing 3600-rpm steam turbine of modern design for central-station service has turning gear, reaction blading, initial impulse-velocity stage, balance piston, thrust bearing as well as the two main bearings

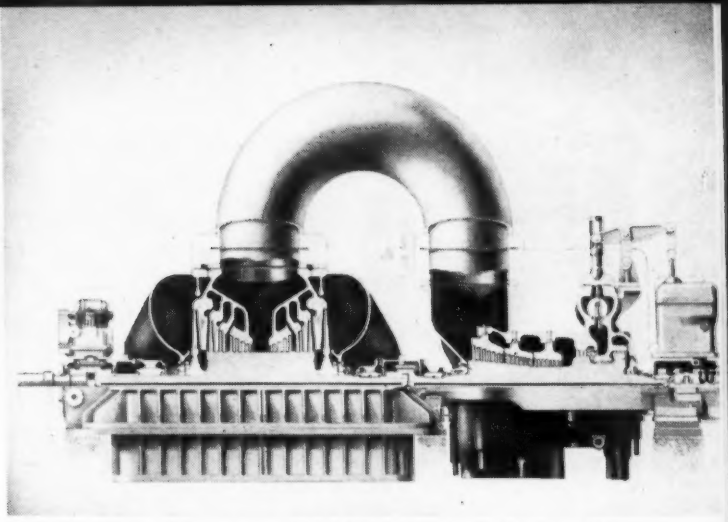


Fig. 5—Tandem-compound 3600-rpm central-station steam turbine of large capacity has single-flow high-pressure turbine and double-flow low-pressure turbine needed to accommodate the steam volume at the low exhaust pressures

Plateau in Long-Time Development

high-speed condensing turbine was produced. By 1937, developments raised the limit to 25,000 kw, shortly followed by the 2-element tandem turbine with double-flow exhaust blading to give a 65,000-kw rating or 81,250-kw maximum output. These units have accumulated several years of successful operating history, upon which is based the development now being made of 2-casing tandem. 3600-rpm turbines extending upwards to 100,000-kw maximum capacity. Several of these new and larger-frame turbines are being designed, with shipments beginning early in 1948.

Acceptance of 10,000-kw turbines and larger, operating at 3600 rpm, is indicated by the fact that 89% of all units in this size range shipped by Westinghouse since 1934 operate at this speed. Also 95% of all large turbines now on order are the high-speed type.

The field for 1800-rpm units has been reduced to a relatively small number of large installations. Even here it is entirely possible that by further compounding of turbine casings the high-speed unit will become a competitor.

The primary factor determining the rating limit for condensing turbines at a given rpm is the annular area for which reliable and efficient last-row blading can be produced. This requires avoiding undue sacrifice in over-all efficiency from the so-called leaving-energy loss, as measured by steam velocity, by keeping it at an economic value. The major advances in rating limits coincide with development of new and larger exhaust-end blading. Each such step needs (1) the utmost attention to detail design of the blade for stress and steam-flow control (2) a thorough understanding and analysis of structure vibration characteristics, and (3) the production of costly new tooling.

In 1929 a last-row blade 17-in. long was developed to provide 20.8 sq ft of annular area with a blade-tip velocity of 1150 fps at 3600 rpm. This made possible the single-casing condensing turbine rated at 10,000 kw. A longer blade, 20 in., brought out in 1937 gave 26% greater last-row annulus with a blade-tip velocity of 1260 fps. The most recent development, a 23-in. blade, effects an increase in area of 25% at a peripheral speed of 1370 fps.

Progressive Steps. Each of these increases to new limits has been made only after extended operation at the preceding ceiling in a large number of machines. Such operation has not always been entirely free of difficulty, but it has invariably led to a solution of the problems encountered before venturing farther. This is the present situation with the 23-in. blade. Ample experience will be obtained before proceeding to higher levels. In making these progressive steps in exhaust-blade construction it has been unnecessary to adopt new materials for blading or rotor, or to raise stress values appreciably. Probably several years will elapse before further increase in blade dimension can be considered.

The growth of exhaust-blade annulus accounts directly for only about half the increase in maximum rating of high-speed turbines since 1929. The remainder is partly accounted for by the reduced steam flow through the last-row blade annulus, particularly with higher steam pressures, because considerably more steam is extracted for regenerative feedwater heating than was the case 18 years ago, Fig. 3. Modern steam pressures and temperature make available some 25% more heat energy per lb of steam as compared to 1929 levels, with a corresponding reduction in steam flow per unit of output, Fig. 1. Furthermore, each of the preceding factors permits increased steam velocity leaving the exhaust blade annulus for a given percentage overall leaving loss.

The exhaust-blade annular area of a 3600-rpm turbine can never equal that of an 1800-rpm unit of similar arrangement. The relationship is about 1 to 4 at comparable stress levels. But important advantages are realizable from the high-speed machine. They include materially decreased total weight, and reduced weight and dimensions of most of the individual parts. These factors facilitate procurement of materials as well as the manufacturing processes, and also reduce the required foundation mass and plant crane capacity.

Smaller Dimensions. These are minor considerations compared with the contribution made to the successful use of elevated steam pressure and temperature. For a given turbine arrangement, doubling the speed of rotation reduces the rotor and casing diameter by 40 to 50%. Thus, peripheral velocity of rotating parts is not doubled when speed

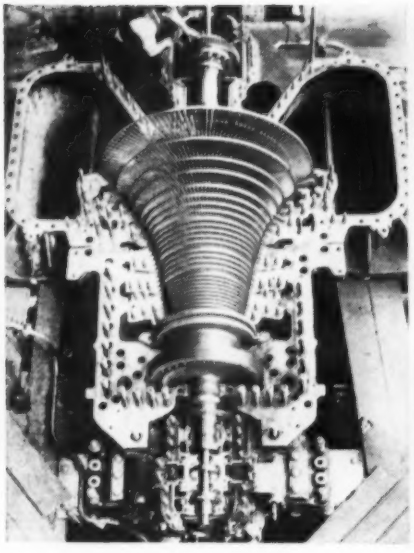


Fig. 6—Partially assembled single-casing turbine with rotor in position

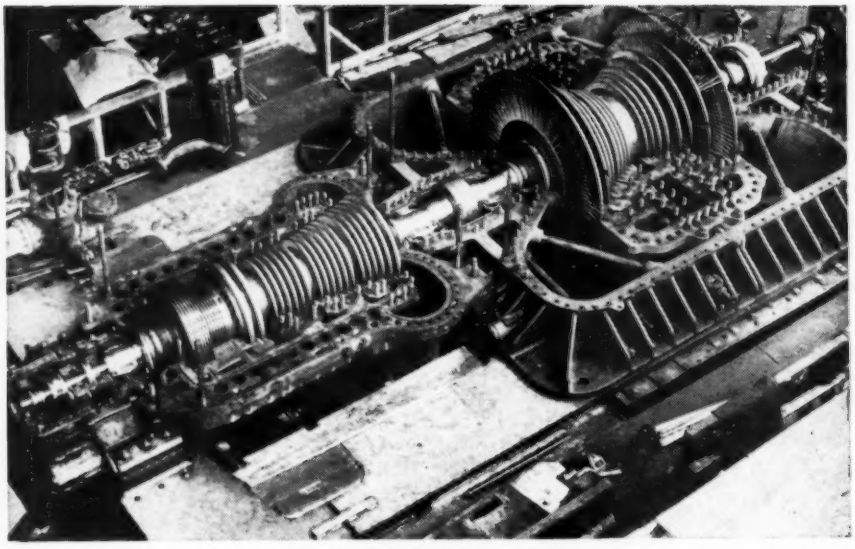


Fig. 7—Partially erected high-speed tandem-compound steam turbine on factory test floor gives perspective view of unit shown in cross-section in Fig. 5

is doubled. Other factors being equal, reduced diameters permit a corresponding reduction in thickness of casing walls and bolting flanges. In turn, this leads directly to a structure that responds more quickly to the wide changes in steam temperature with smaller transient gradients in metal temperature, which produce distortion, temporary or permanent.

For the same reason the higher-speed machine can be started from cold or partly cooled condition and put on the line quicker. Also, smaller blading diameters in the early stages of the turbine are conducive to improved efficiency of energy conversion when handling the relatively small volumes of steam associated with prevailing elevated pressures. Growth of the 3600-rpm turbine is, therefore, based upon sound fundamentals which have been verified by a wide and extended service.

STEAM CONDITIONS.

Plant thermal economy is enhanced by elevating both steam pressure and temperature. History shows that between incremental increases in either or both are plateaus of some duration to allow thorough development of equipment for the new condition before proceeding to the next.

Superposed turbines have led the way in raising steam pressures, reaching 1200 psig nearly 20 years ago at moderate temperatures, and arriving at 1600 psig and 950 F in 1942. Most of the new, larger condensing turbine installations are being designed for steam supply at 850 psi, 900 F, a condition well established by as much as ten years' operation. A much smaller number will use 1250-psi 950-F steam which is supported, also, by several years of operation.

Forward-looking steps being taken currently are to 1500 and 1800 psig at 1000- to 1050-F temperature. Specifically, a condensing turbine rated at 40,000 kw is being designed for 1650 psig, 1000 F, another for 100,000 kw at 1500 psig, 1050 F, and a third for 65,000 kw with 1450 psig, 1000 F with intermediate-pressure boiler reheat to 1000 F. Each will operate at 3600 rpm, tandem compounded with double-flow low-pressure blading. The reheat unit, a recommended procedure, will have three turbine elements, not two, in tandem.

Limiting Factors. Practical limits of steam pressure and temperature ultimately may be determined by the turbine, steam generator, superheater, piping or auxiliaries. The economical limits are a function of equipment cost, service availability, fuel cost, load factor, etc. A new plateau is likely to be established on the time curve of both steam pressure and temperature, at the levels for which the new turbines are now being designed. Assuming operation with 1050-F steam proves practical and economical for plants of high load factor, the corresponding steam pressure could be advanced from 1500 to about 1800 psig without particular difficulty as far as the turbine is concerned.

A plant using 1250-psig 950-F steam has about 4.5% lower heat rate than with steam at 850 psig, 900 F. Also, 1500 psig at 1000 F may result in additional reduction of about 3%. For estimating purposes, it can be assumed that a properly selected single-stage intermediate reheat to the initial steam temperature brings a 5% reduction in heat rate. Likewise with such reheat, comparable heat rates are obtained with 150-F reduction in initial steam temperature. These comparisons are approximate, subject to variation in specific cases. They are not applicable independent of size or equipment arrangement.

It is our opinion that 1050-F temperature will not be exceeded in the early future. If fuel prices continue their upward trend an increasing number of desirable reheat installations will be made at 950- to 1050-F temperatures.

STANDARD TURBINES.

A substantial measure of standardization has now become available in the large-turbine field, and has attained considerable buyer acceptance within the past year. Proposed jointly by the AIEE and ASME, six ratings of condensing 3600-rpm turbines from 11,500 to 60,000 kw are included. With each of the four lower ratings—11,500, 15,000, 20,000 and 30,000 kw—these standard units have fixed inlet steam conditions consistent with pressures and temperatures existing in many turbines purchased recently for each such capacity level. The 40,000- and 60,000-kw standard turbines have each two optional steam conditions: one 850 psig, 900 F and the other 1250 psig, 950 F. The higher one, 1250 psig, 950 F, is above that of most recent purchases. All frames have specified and fixed extraction points for feedwater heating.

whether actually used or not. Each unit has a specified maximum guaranteeded capability output of 110% of rating with an absolute exhaust pressure of 1.5 in. Hg with all extraction points in full use.

Exhaust Pressure. The standardization program presupposed that each manufacturer would provide his desired contingency marginal steam-flow capacity, over and above that required by the guarantee of maximum kw capability. About 105% of maximum-load steam flow is customarily provided. It so happened that the first standard units considered were for installation in the South. In such a warm climate the condenser circulating water is not cool enough to give the standard exhaust pressure of 1.5 in. Hg abs. Standardized turbines were designed, therefore, to provide ample steam flow to meet the specified capability guarantee with standard steam conditions, but with the exhaust pressure increased to 2.5 in. Hg abs. Other factors being the same, this higher pressure coincides with a 17-F increase in circulating-water temperature.

This variation makes it possible to furnish a standard turbine without sacrifice in the standard guaranteed output for practically any location in the U. S. A. For plants that do obtain the lower exhaust pressure, the contingency marginal steam-flow capacity is thereby increased 2 or 3%, depending on the particular unit and steam condition selected.

Nonstandard Units. Several factors can make purchase of a standard turbine inadvisable, such as duplication of old units or connection into an existing steam header system not coincident with adopted standard. Nevertheless, the acceptance of standardized turbines has exceeded expectations. Of all condensing turbines on order with Westinghouse to drive 60-cycle generators of 10,000- to 60,000-kw capacity, standard units account for 45% of the number of units, and 55% of aggregate rating.

Standardization means repetitive manufacture and installation of thoroughly demonstrated equipment. After completing initial design of each frame it permits immediate issuance of ordering and manufacturing information for all parts, except possibly the oil piping. Simultaneous manufacture of several duplicate standard units gives substantial assurance against delay caused by possible rejection of a large casting or forging. Under normal circumstances, with manufacturing schedules not crowded, as at present, the standard machine should be produced in less time than is needed for the nonstandard unit. Time saving includes that required for special development and what accrues from stocking major parts. Also, plant design and arrangements for foundations can start immediately to match the accelerated production schedule and realize earlier initial operation.

One of the logical results of reasonable activity in the purchase of standard designs is lower cost. Anticipating standards acceptance and to stimulate consideration of standard machines, a price reduction of several percent was immediately offered so that early buyers would not be required to underwrite the savings of those who followed.

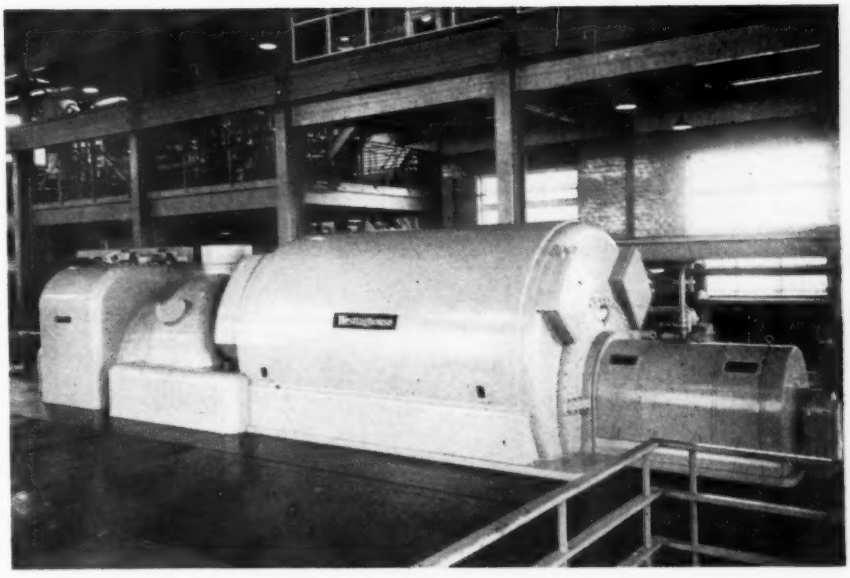


Fig. 8—20,000-kw 3600-rpm single-casing hydrogen-cooled steam turbine-generator unit with direct-connected exciter as installed in Southwestern station

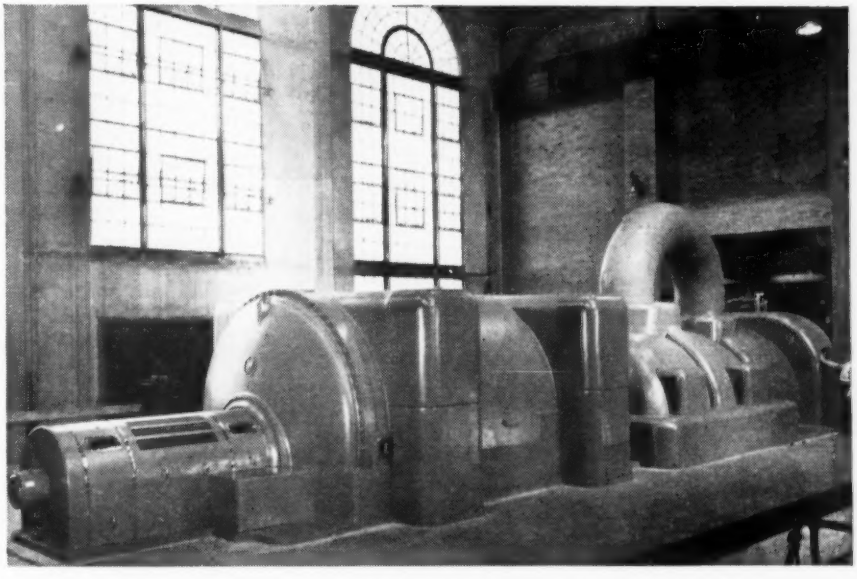


Fig. 9—Large-capacity high-speed tandem-compound steam turbines occupy much smaller floor area than comparable sized units designed 20 years ago

HOW HOT IS IT?

When all types of complicated temperature-measuring devices failed to perform properly in research on gas-turbine wheels, engineers of the General Electric Co, hit on a relatively simple solution. Parts of the turbine were made of a special metal alloy that tells its temperature by color.

The alloy changes color for every 25-deg temperature change from 500 to 700 C. It then reverts to its original color and repeats the color scale from 725 to 900 C.

Heavy and Light Oils Blend Into Medium Grades

Oils of high and low viscosity are easily converted to new grades. C M Larsen, chief consulting engineer, Sinclair Refining Co, tells how to blend oils by viscosity and check for dilution

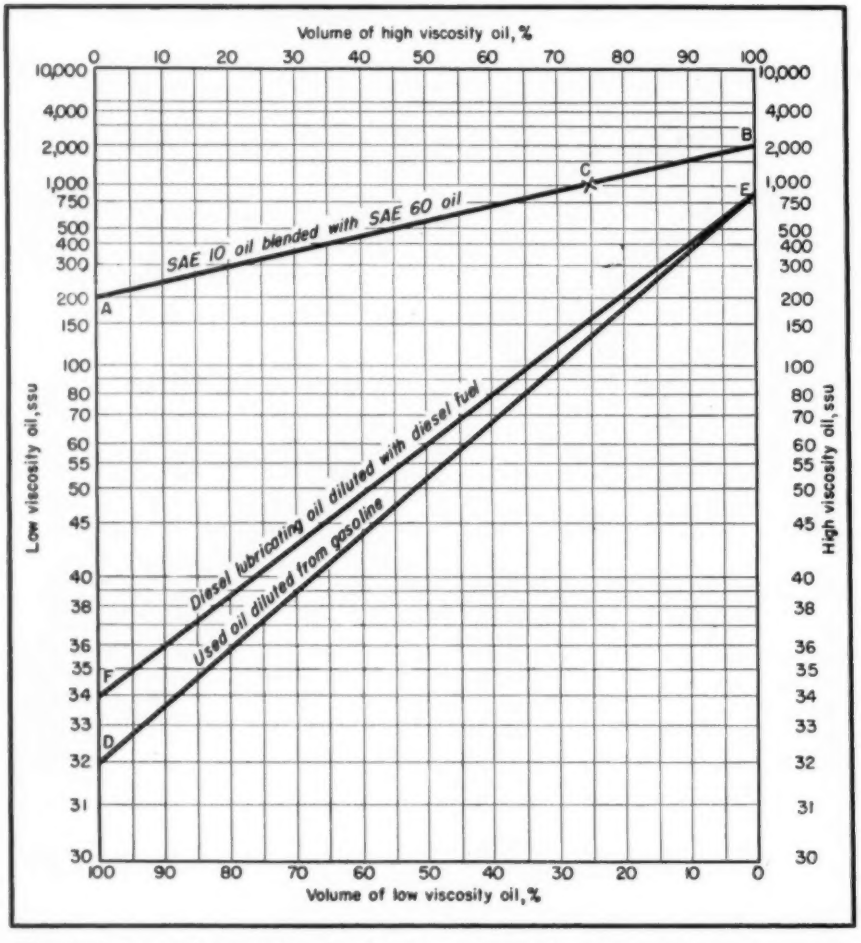


Fig. 1—Intermediate grade of lubricating oil blended from high and low viscosities. Curve ACB shows how to blend SAE 40, point C, from 10 and 60

► THE VARIOUS GRADES in oil in the SAE 20, 30, 40 and 50 ranges are generally a blend of SAE 10 with 60 or 70 oil.

The quantities of these oils, for producing intermediate viscosities between light SAE 10 and heavy SAE 60 or 70, can be estimated in a simple way by using a blending chart. Such a chart supplies the viscosity of a mixture of petroleum liquids when the viscosities of the components at one temperature are known. This is done by plotting the lower viscosity component on the left scale and the higher viscosity component on the right scale, Fig. 1.

By drawing a straight line through the two points, *A* and *B*, which represent viscosity of each oil plotted at 100 F, the different proportions of each are read at the top and bottom percentage scale for a desired final blend of, say, 1000 seconds ssu at 100 F. Such a 1000-second oil, point *C*, would require 25% of low-viscosity 200-second oil blended with 75% of high 2000-second oil for this desired viscosity of the finished oil, which comes out SAE 40 grade. Other blends are made by adjusting the points to fit the viscosities of the oils.

The lubricating oil of internal-combustion engines, powered by gasoline or diesel fuel, changes viscosity by a loss through dilution caused by fuel blowby or leakage. Relative loss of

viscosity, from equal amounts of dilution, is far greater with gasoline, as shown by line *D-E*, than for diesel fuel dilution, line *F-E*, Fig. 1.

The dilution of diesel-engine lubricating oil is often the underlying cause of engine casualties. A small quantity of diesel fuel oil causes a relatively large decrease in viscosity, thus seriously impairing the lubricating qualities of the oil so that piston seizure, excessive blowby and bearing troubles are more likely to result. Diesel-engine lubricating oil that is diluted with fuel oil in excess of 5% should be drained and replaced.

One of the simplest methods of estimating the percent fuel dilution of the lubricating oil by the diesel fuel oil is based on the change in viscosity of the used oil when compared to an unused sample. The percent dilution may be obtained from the lubricating-oil dilution chart, Fig. 2. Such charts are already used by the Navy for diesels afloat and by railroads for diesel locomotives. They apply equally well to stationary engines.

A simple ball-type, direct-reading viscosity comparator, known as the Visgage, Fig. 3, is well adapted to the determination of dilution. It consists of two calibrated glass tubes, each containing a stainless steel ball, mounted parallel on each side of the graduated scale, reading vertically in saybolt seconds universal at 100 F. Top master tube is filled with a 400-second oil at 100 F while the lower trial tube is provided with a plunger for drawing in a sample of the lubricating oil to be tested.

The viscosity dilution chart is used to obtain dilution directly in percent. To obtain percentage of dilution of used diesel-lubricating oil, determine with the Visgage viscosity at 100 F of used oil, and also a sample of unused oil from the same lot. Locate these values on the chart, Fig. 2, and draw horizontal and vertical lines for each oil. The point of intersection of these lines indicates the percentage of dilution. This value is read from the nearest diagonal line.

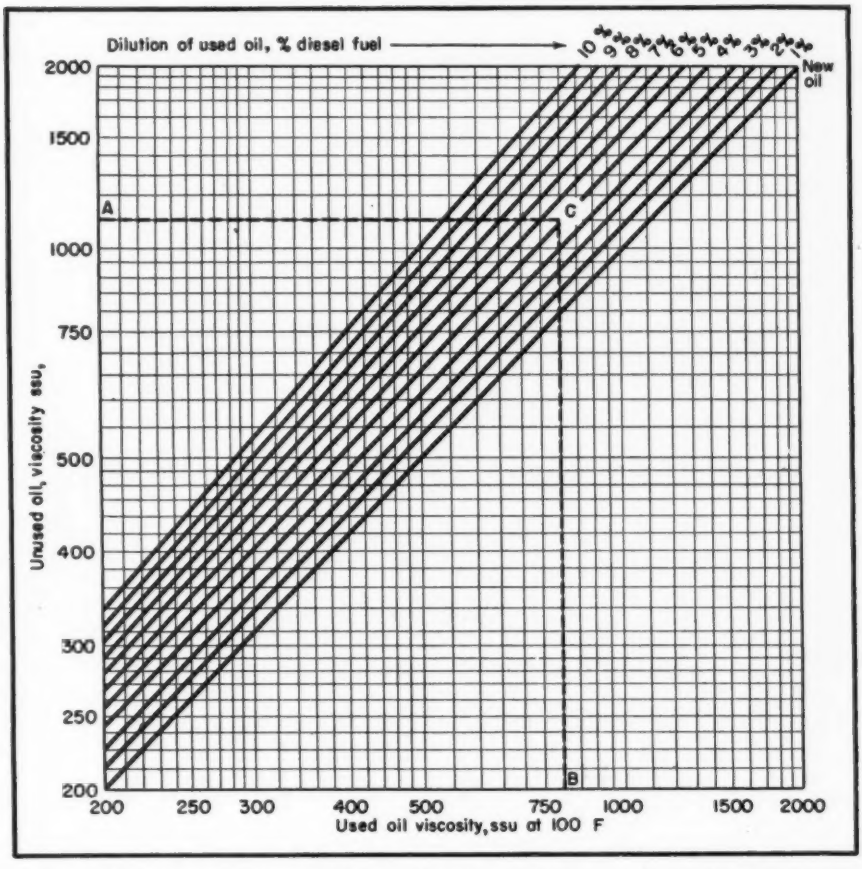


Fig. 2—Dilution percentage of lubricating oil with fuel can be determined from these curves. Point C indicates 4% dilution of the oil at A to condition B

Example: Assume the viscosity of the unused oil *A* is 1100 seconds, point *A*, and the used oil is 800 seconds, point *B*. From points *A* and *B* draw horizontal and vertical lines to the point of intersection *C*. Point *C* falls on the 4% line, which is the amount of dilution of the used lubricating oil.

When oils are heated excessively for long periods they oxidize and become more viscous. This increase in viscosity of the used oil can be determined from Fig. 2 by comparing the unused and used viscosities, as was the case with diluted oils. For the oxidized oil the viscosity increases, whereas with diluted oil it decreases. Again we see that viscosity is the most important property of lubricating oil, whether for blending new oils or for operating limits of used oils.

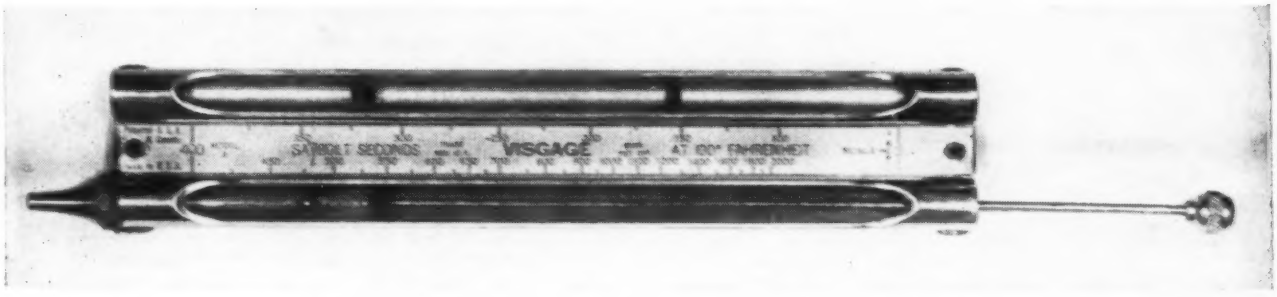
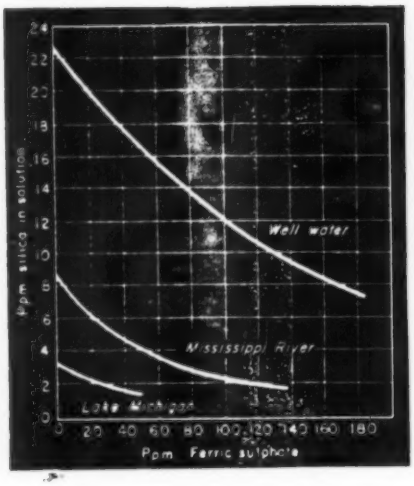


Fig. 3—Simple ball-type comparator, called Visgage, gives the viscosity in saybolt seconds universal of any sample at 100 F. Instrument works by filling tube with unknown oil, and then tilting and readying travel of the two balls



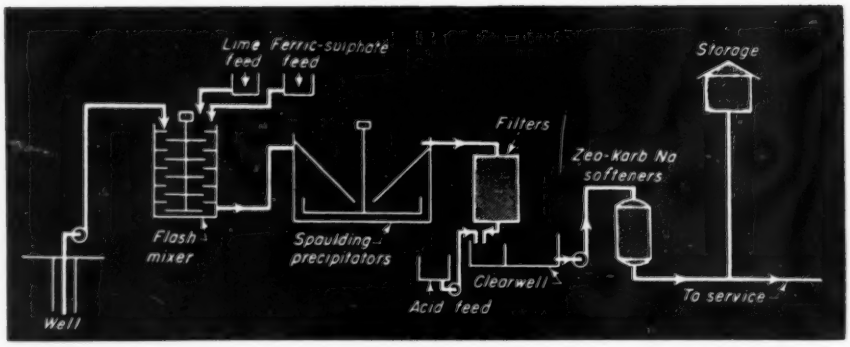


Fig. 1—Chemicals cost 0.2 to 0.6 cents per ppm per 1000 gal when removing silica by the ferric-sulphate process. It reduces silica to about 2 to 3 ppm

Fig. 2, left—Amount of ferric sulphate added to water of a given silica content determines the reduction of silica in effluent water from treating system

Five Ways to Remove Dissolved Silica From Boiler Feedwater

Troublemaker in high-pressure boiler plants can be removed from makeup water by cold or hot process treatments. Latest developments is demineralized feedwater free from silica*

By M E GILWOOD
Assistant Manager of Research
The Permutit Co

► SILICEOUS SCALE in boiler tubes generally results from the presence of calcium, iron or aluminum in the feedwater. But sometimes the deposit consists of virtually pure silica. In such instances, the difficulty is eliminated by increasing the ratio of alkalinity to silica in the boiler water or by improving circulation to avoid dry, hot spots in the tubes.

But such measures do not reduce the amount of siliceous deposits in the lower-pressure stages of turbines when the steam supply is produced at comparatively high pressures. The deposits are more frequent with increased pressures and higher amounts of silica in the boiler water. Only suitable remedy found thus far is to reduce the dissolved silica in the boiler water.

To avoid condensate line corrosion, general practice is to lower the feedwater alkalinity to a minimum because this method reduces the amount of CO_2 in the steam. Reduction in feedwater alkalinity lowers the boiler water concentration. Maintaining a sufficiently high ratio of alkalinity to silica under this condition, however, makes it necessary to reduce the silica content of the feedwater. To minimize blowdown, total solids in the feedwater must be brought to the lowest possible limits. But when blowdown is minimized makeup-water concentration in the boiler is increased.

Residual silica permissible in feedwater depends on the allowable silica in the boiler and on the number of concentrations that the feedwater undergoes here. Often the amount of blowoff is determined by the maximum permissible concentration of solids other than silica in the boiler. In very high-pressure boilers, it is often necessary to increase blowoff to limit the maximum silica as a precaution against either boiler scale or siliceous turbine deposits. If the feedwater contains considerable silica and the maximum allowable amount in the boiler is very low, control of silica in the boiler water, by adjusting the blowoff, is expensive. Accordingly, it is necessary to reduce the feedwater silica content.

* Abstract of a paper presented at the seventh annual water conference of the Engineers' Society of Western Pennsylvania, Jan 7, 1947.

A variety of processes are available for removing silica from water. In selecting the proper treatment it is essential to determine what process gives the most economical over-all boiler and water-plant operation.

Removal by Ferric Sulphate. Feeding ferric sulphate and alkalies to the water precipitates absorptive ferric hydroxide, a compound that effectively removes silica from water when its pH is maintained at about 9.0-9.5. Best results are obtained at atmospheric temperatures; ferric hydroxide is not suitable for removing silica from hot water.

Amount of ferric sulphate required varies with the initial SiO_2 content and the amount of silica tolerable in the treated water. Fig. 2 indicates results obtained with ferric sulphate. Fig. 1 shows a flow diagram of an installation. Chemical cost is 0.2 to 0.6c per ppm per 1000 gal of treated water. The ferric-sulphate process is suitable for commercially reducing silica to about 2 to 3 ppm. Since the operation is carried out at normal tempera-

ture, the treated water can be zeolite softened readily.

Although ferric sulphate may be used simultaneously for silica removal and as a coagulant on turbid waters, its use has been limited because it greatly increases the total dissolved-solids content of the treated water: When the ferric ion, supplied by the ferric sulphate, precipitates as ferric hydroxide, the sulphate ion remains dissolved in the water.

Magnesium Oxide. This method employs both cold and hot processes.

1. *Cold process:* Treatment depends on absorption of silica by magnesium oxide or freshly precipitated magnesium hydroxide. For satisfactory removal it is essential to contact the magnesia effectively with the water in a precipitating unit of sludge-blanket type. Silica-removal efficiency is improved by increasing the time of water contact with the sludge absorbent in an agitated suspension.

Magnesium hydroxide, precipitated from the magnesium ion, is the most efficient magnesia-type silica absorbent. Undissolved magnesia compounds of proper quality, however, are also satisfactory if the concentration of magnesia in the sludge blanket and suitable contact time are maintained. Increasing the water temperature improves silica removal. Usually wasted heat can be employed for prewarming the water.

Satisfactory treatment in cold-process equipment can be obtained by feeding magnesium oxide and the necessary alkalies to water entering the precipitator. Usually, because lime is required, it is most economical to employ dolomitic lime $Ca(OH)_2MgO$: It supplies the calcium hydroxide for precipitating bicarbonate and magnesium ions, and simultaneously supplies magnesium oxide for silica absorption.

It is often necessary to increase the magnesium-ion content in the influent water to obtain suitable removal. Magnesium ion can be added economically, without increasing the lime requirements or the total dissolved-solids content of the effluent, by recirculating sludge from the precipitator into a magnesium-dissolver tank. Fig. 3. Here, the sludge is mixed with the raw water before it enters the precipitator. HCO_3 and CO_2 present in the raw water dissolve magnesia in the recirculated sludge, thus introducing magnesium ion to the water. If necessary, additional CO_2 may be added to increase further the amount of magnesium ion dissolved.

The cold-process magnesium-hydroxide treatment removes silica from water to about 2 to 3 ppm in the treated effluent. Chemical cost is about 0.1 to 0.2c per ppm per 1000 gal of water treated. The method removes turbidity and generally reduces not only the silica but also such other dissolved solids as carbonate hardness, iron etc. present in raw water. The precipitator-treated water is at a suitable temperature for zeolite treatment.

2. *Hot process:* Absorption of silica by magnesia is improved by higher water temperatures. Operators of some hot-process softeners have added the feature of silica removal by merely feeding dolomitic lime, or activated magnesia and lime, and recirculating some of the settled magnesium-containing sludge from bottom to top of the softener tank.

For best efficiency in hot-process equipment, however, it is desirable to employ a sludge-blanket hot-process softener. This treatment makes it possible to obtain the advantages of high temperature and intimate sludge contact between water and magnesium oxide. Silica removal is excellent.

Sludge contact in the unit produces lower turbidity in the effluent than in a conventional hot-process softener, thereby reducing filter load. A treated effluent containing less than 1.0-ppm silica often can be obtained when using only dolomitic lime for treatment. Chemical cost may be as low as 0.03 to 0.1c per ppm SiO_2 per 1000 gal of treated water.

Fluosilicate Anion Exchange. Two-step demineralizing, Fig. 4, removes virtually all electrolytes present in a water. Although the effluent compares to distilled water in electrolyte content, demineralizing has not been generally adopted for treating boiler makeup because it does not reduce the silica content.

Since demineralized water contains only a few ppm of dissolved solids other than silica, the latter must be reduced to a small fraction of a ppm so blowdown can be reduced to a degree comparable to the reduction of dissolved electrolytes in the demineralized water. First silica-reduction method developed, based on the 2-step demineralizing process, is the fluosilicate anion-exchange system.

In operation, influent water passes through an acid-regenerated organic cation exchanger, which removes metallic cations such as sodium, calcium and magnesium. Hydrogen ion is released in equivalent amounts to the water, thus producing HCl, H_2SO_4 and H_2CO_3. The effluent then enters an anion exchanger where the hydrochloric and sulphuric acids are absorbed. Carbonic acid (H_2CO_3) decomposes readily into CO_2 and water, and the CO_2 can be removed in a de-

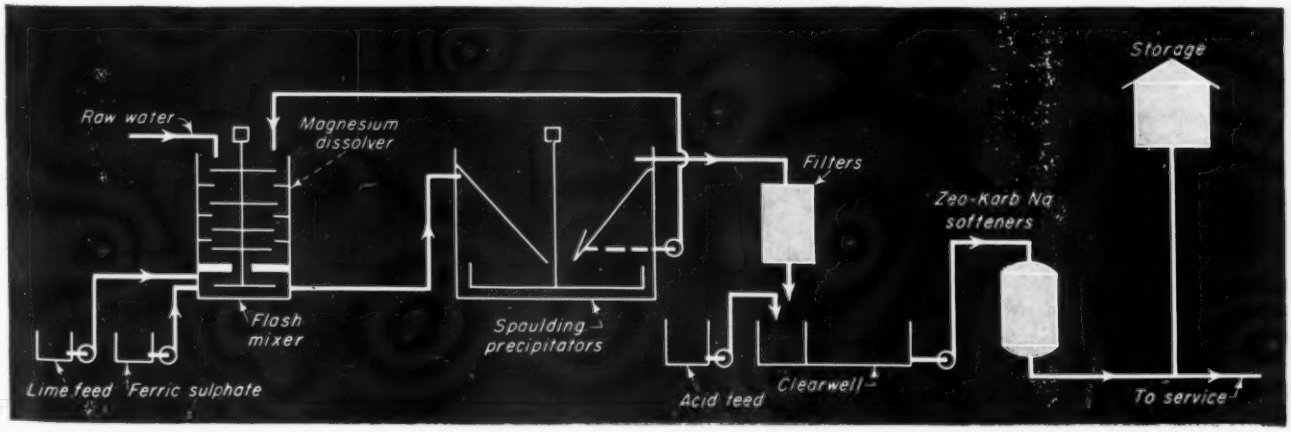


Fig. 3—Magnesium ion can be added economically without increasing the lime requirements or the total dissolved solids content of effluent by recirculating magnesium-containing sludge from precipitator to the dissolver tank

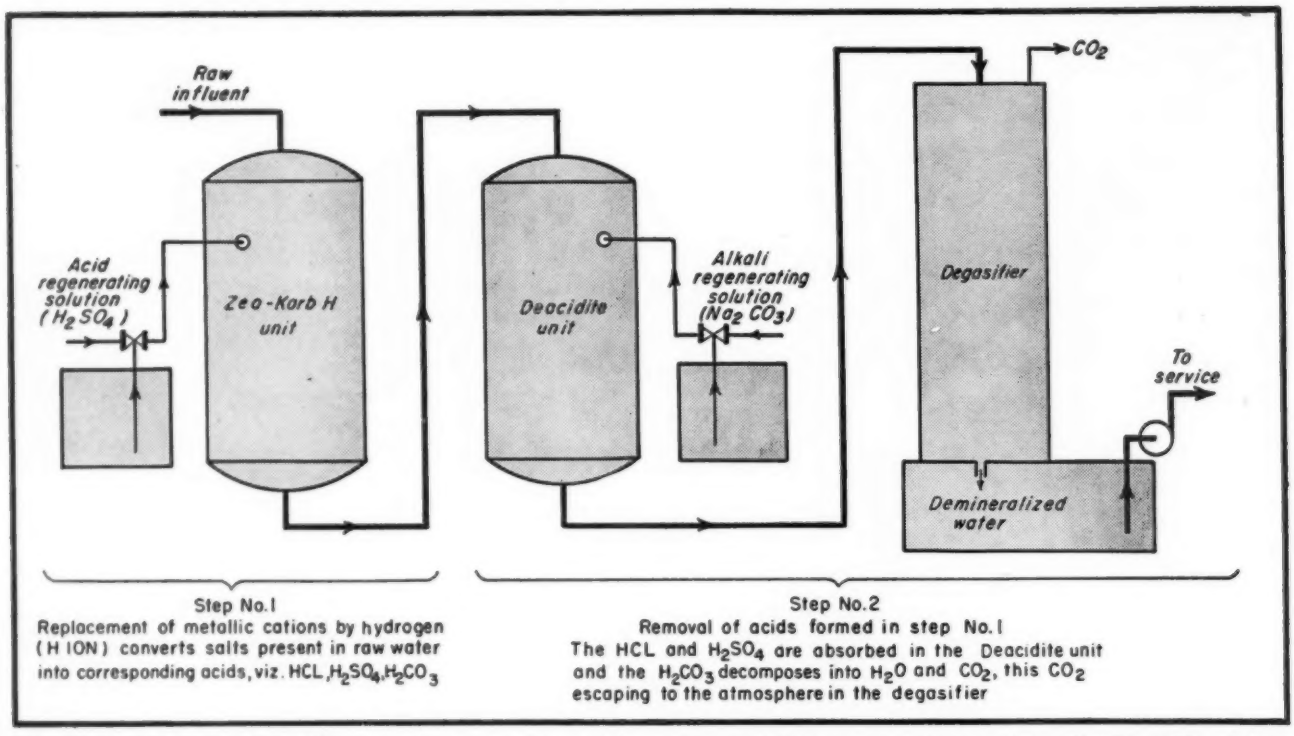

Raw influent
Acid regenerating solution (H_2SO_4)
Zeo-Karb H unit
Deacidite unit
Alkali regenerating solution (Na_2CO_3)
CO_2
Degasifier
To service
Demineralized water
Step No.1
Replacement of metallic cations by hydrogen (H ION) converts salts present in raw water into corresponding acids, viz. HCL, H_2SO_4, H_2CO_3
Step No.2
Removal of acids formed in step No.1
The HCL and H_2SO_4 are absorbed in the Deacidite unit and the H_2CO_3 decomposes into H_2O and CO_2, this CO_2 escaping to the atmosphere in the degasifier

Fig. 4—A 2-step demineralizing system converts metallic cations to their respective acids (step 1), then removes acids in anion exchanger (step 2). Degasifier drives off the resulting carbon dioxide. Silica is not affected

gasifier. When the cation exchanger capacity has been exhausted, the unit is regenerated by passing a dilute solution, usually sulphuric acid, through the bed. In a similar manner, the anion unit is regenerated with soda-ash solution.

To remove the silica it must be converted into a strong or highly dissociated acid, which can be readily removed by the anion exchanger. Hydrofluoric acid and silica react even in very low concentrations to form fluosilicic acid that is readily absorbed by commercial anion exchangers.

It is readily possible to feed hydrofluoric acid directly to the anion-exchange-unit influent (step 2 in the demineralizing process), but the acid is extremely difficult and dangerous to handle so other means of supplying it to the water are employed.

Simplest method is to feed sodium fluoride, Fig. 5, to raw water entering the hydrogen zeolite or acid-regenerated cation exchanger unit (step 1 in the demineralizing process). Hydrogen zeolite converts the sodium fluoride to hydrofluoric acid in the same way that other salts in the raw water are converted to their corresponding acids. Hydrofluoric acid thus formed immediately reacts with the silica to form fluosilicic acid.

If sufficient sodium fluoride is fed, the fluosilicate anion exchange process delivers a treated water, after degasification to remove CO_2, virtually free of silica (below 0.2 ppm SiO_2) regardless of the influent content. The effluent contains an average of about 0.5-1.0 ppm fluoride. Some question has been raised regarding operating difficulties that may be encountered if fluoride is present in the boiler water. This subject requires further study as little information is available.

Cost of the fluosilicate anion exchange process is fairly high, per ppm of silica removed, when compared to older silica-removal methods because 4.2 ppm of sodium fluoride (an expensive salt) must be added for each ppm of silica if the process is 100% efficient. Even greater amounts of it are required in actual practice for satisfactory results. Cost is also increased appreciably by the extra acid and alkali required to remove, by de-

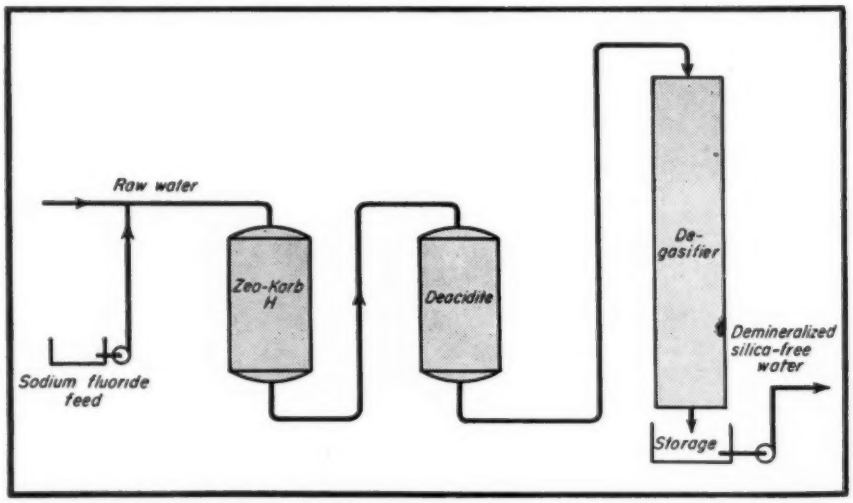


Fig. 5—Sodium fluoride fed to the entering water is converted to hydrofluoric acid, which reacts with silica to form fluosilicic acid, subsequently removed

mineralizing, sodium fluoride added in the treatment. The fluosilicate anion exchange process is important, however, because it produces a virtually silica-free demineralized water.

Direct Absorption. After much laboratory work, we found that silica can be absorbed from hydrogen-zeolite treated cation-free water by caustic-regenerated, specially prepared, highly basic anion-exchange resins. Because such resins also absorb hydrochloric, sulphuric and carbonic acids, the presence of these stronger acids appreciably affects silica removal.

It is generally advantageous to remove the strong acids before passage into the silica-absorber unit, Fig. 6. Hydrochloric and sulphuric acid can be readily absorbed by a conventional anion unit. Since carbonic acid decomposes into water and CO_2, the carbon dioxide can be most economically removed in a standard degasifier.

By properly controlling operation it is possible to obtain a demineralized water containing only a fraction of a ppm of dissolved silica. Cost of treatment varies from about 0.3 to 0.6c per ppm of silica removed. Since this is a new development, the durability and life of the silica-absorber resin must be carefully checked for a large number of repetitive cycles. Accordingly, for the time being we are installing only a limited number of such plants on selected water supplies.

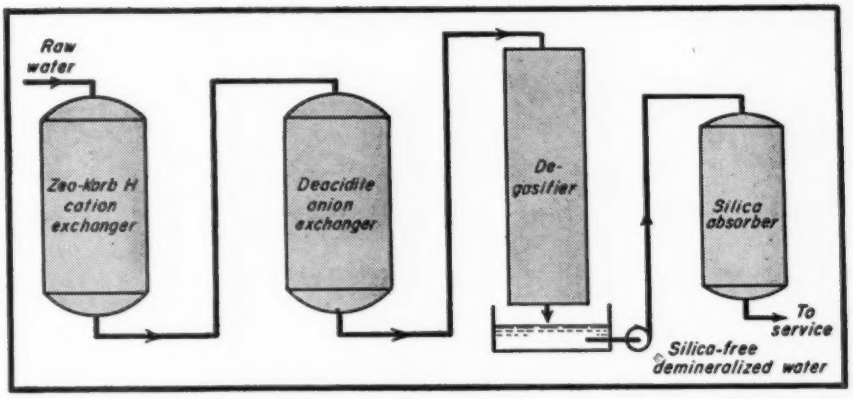


Fig. 6—Silica can be absorbed by special caustic-regenerated resins. Usually it is advantageous if the water is first passed through a 2-step demineralizer

Combination Treatment. Frequently it is necessary to treat surface supplies by coagulation and filtration to remove suspended matter. If a precipitator-type clarifier is required it is advantageous to employ magnesia treatment and thus obtain silica removal simultaneously with removal of suspended solids. Any of the other treatments can be employed, supplementary to the magnesia treatment if desired, to remove the last few ppm silica. Because it reduces silica at the lowest cost per ppm removed, and without increase in dissolved solids, the magnesia pretreatment is desirable for the sake of economy. Before deciding which treatment to use, make a complete engineering-economic study to determine which process will give the most economical over-all boiler and water-plant operation.

Seeks Stoker Design for Brown Coal

▶ MELBOURNE: To the state of Victoria, in Australia, the world's most popular engineering genius would be the designer of a steam furnace, 100% satisfactory on brown coal.

Until the war's crisis, coal from New South Wales fed the boilers of Victoria. Then this state, which is becoming the country's industrial hub, "discovered" brown coal as an industrial-power source. Enormous deposits were known to exist, and 3000 tons were mined by open-cut methods in 1913. Only with the advent of World War II did unbriquetted brown coal find general acceptance in boiler plants. Changeover from black to brown coal is the most conspicuous trend in industry since the war.

This brown coal ascendency finds engineers unable to design an absolutely dependable stoker for plants of every capacity. Victorian brown coal averages 30.4 to 59.5% moisture as mined, but ash rating in no sample exceeds 9.1%. Typical analysis for the big open-cut at Yallourn is 49.5% moisture as mined, 25.8% volatile hydrocarbon, 22.7% fixed carbon, 2.0% ash.

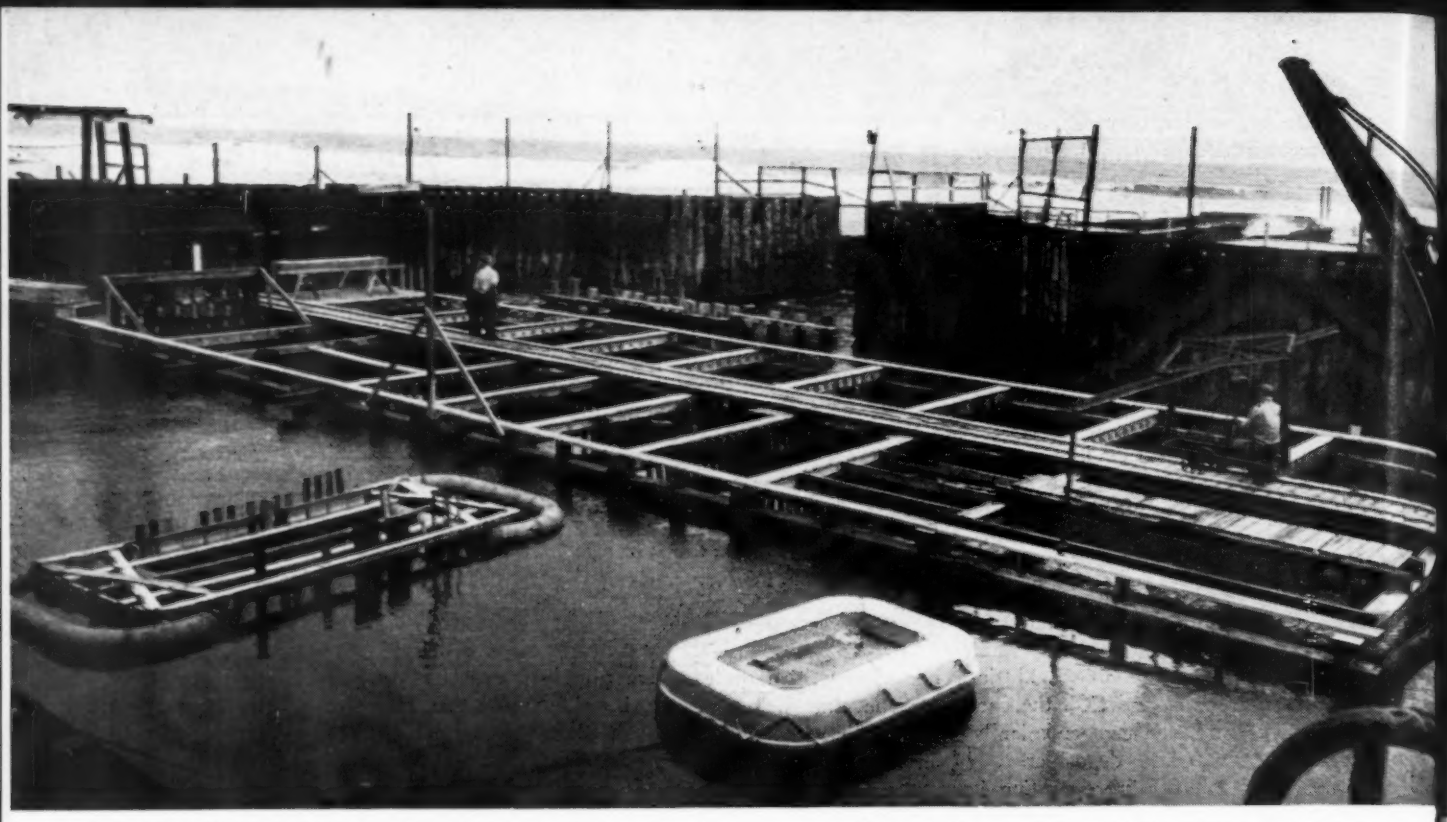
The high residual moisture content after air-drying causes ignition difficulties, increase in flue-gas heat loss due to high moisture content of flue gas, and corrosion in steel stacks due to high moisture and sulphur content of flue gas. Moreover, the coal tends to become friable, causing the fuel bed to pack when worked, thus increasing resistance to draft. But compared with black-coal ash problems, the ash content is easy to deal with.

Most conventional chain grates do not operate successfully on brown coal unless it is burned with bituminous coal, fuel oil or tar. But 90% of boiler rating has been attained on a comparatively old design by a preignition grate with a forced-draft device to maintain intense fire. Some form of forced draft must also be provided to make hand-fired boilers carry more than 75% boiler rating.

Screw-type underfeed stokers offer promise in burning brown coal if screw capacity can be increased to cope with the larger brown-coal bulk. In tests with a boiler rated 5500 lb per hr a continuous rating of 7000 lb per hr could be maintained because of absence of ash and coking troubles.

As ordinary on-off control can lead to trouble, automatic combustion control is important if good efficiency is to be obtained with spreader stokers.

None of the furnaces that burn bituminous coal gives satisfaction under all loads and conditions on brown coal. To speed stoker development, the Premier of Victoria is considering asking for the loan of German combustion engineers to carry out needed research.



TESTS THE ACTION of salt water and marine growths. Samples are submerged in a basin that is protected against wave action. A large, open conduit connects with ocean so basin water circulates in and out as the tide changes

Marine 'Lab' Aids Corrosion Research

In a constant fight against corrosion, science gives protective materials a tough assignment in pitting them against destructive actions of marine life, salt water, sunlight and spray

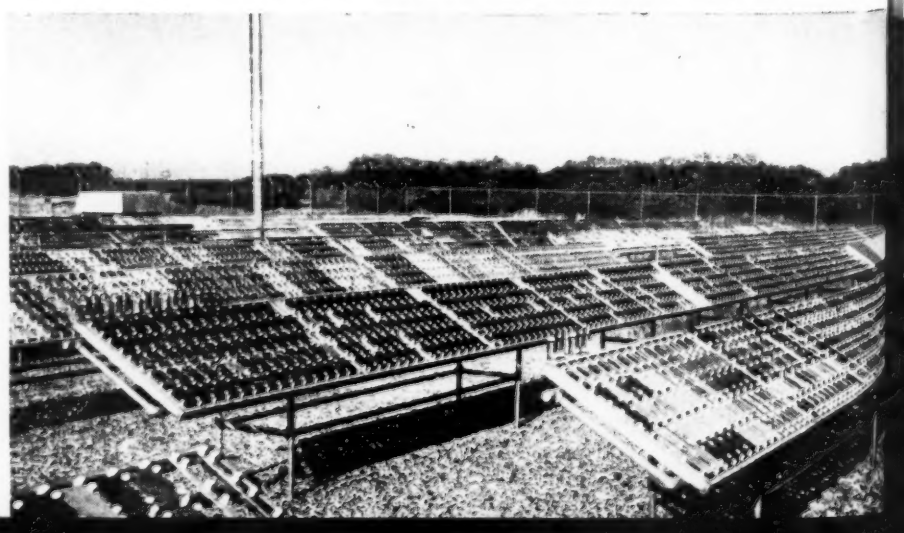
By E W FELLER
Associate Editor

▶ COOPERATIVE RESEARCH is workable as results prove at Kure Beach, near Wilmington, N. C. The project, established in 1935 by International Nickel Co under the direction of F L LaQue, had as its original purpose the comparison of corrosion resistance of low-alloy steels with that of carbon steel. Soon other materials were added so that eventually the program included comparative tests on all kinds of ferrous and nonferrous metals and alloys. Later on, testing facilities were extended to observe the cathodic protection offered by magnesium electrodes, behavior of metallic and organic coatings and antifouling formulations, effects of marine life on wood and metals, and the action of sea spray and air on rope.

Significant feature is the way producers of competitive products unite to fight the common enemy—corrosion. International Nickel Co and The Dow Chemical Co share maintenance and development costs. Carnegie-Illinois Steel Corp and American Rolling Mill Co joined in setting up test racks. Data accumulated over the years are freely exchanged. They are available to industry as well as government agencies.

Some idea of size can be had from the fact that almost 18,000 samples are exposed to one of several conditions. Sea-water tests put the ocean in a test tube, capturing the tides and other factors that exist along the shore; bulkheads break the force of the surf. Here most specimens are arranged on racks

TESTS THE ACTION of salt atmosphere. Thousands of samples are set at an angle of 30 degrees, facing south. Porcelain insulators prevent galvanic action



TESTS THE EFFECT of cathodic protection. Magnesium anodes are submerged and wired to steel piling. Resistors connected in the circuit limit current flow

and immersed from three to four feet.

Condensers and Pumps. Of special interest to power engineers are tests on metals and alloys that must withstand service in salt water. One device, known as the *whirligig*, is a large motor-driven monel disk that can be submerged in the test basin. Condenser-tube specimens, fastened to the disk, are whirled through sea water at velocities up to 30 fps. Specimens are insulated from the disk and from each other. Holding brackets simulate sections of tube sheets. As the disk revolves, salt water rushes through the tubular test pieces under great turbulence, which produces erosive effects as severe as any likely to be encountered in service.

Another setup, the aspirator-type jet-impingement apparatus, subjects the specimens to the action of submerged jets of salt water mixed with air bubbles. Destructive effect of these two machines produces as much corrosion in two months as ordinarily occurs in as many years. Alloys of 70-30 and 90-10 copper nickel with 0.8% iron stand up best under these tests.

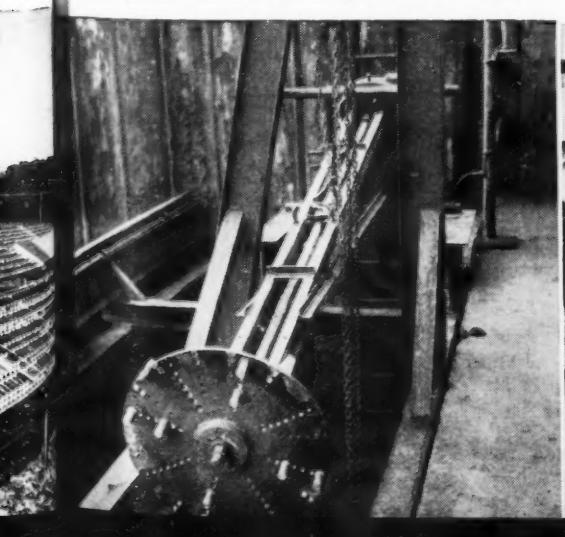
Marine piling is exposed in the identical form and as nearly as possible under the identical conditions found in service. Steel specimens are either interlocking piling or I-beams, driven 20 ft into the ocean bottom and extending 16 ft above the mud line through the water into the air. Corrosion progress is measured by micrometer around the periphery of holes drilled at intervals over the exposed length.

Marine Growths. Studies of the antifouling characteristics of metals, alloys, plastics and protective coatings against marine growths are carried on with the active cooperation of Dr W F Clapp, specialist in marine growth. His work has provided valuable data regarding the destructive Teredo, a marine mollusk that drills into wood and other material. In his opinion coal tar creosote, thoroughly impregnated into the heart of wood piling, is the only preservative that has long-range value in controlling attack by Teredo. Rather than having a toxic effect, the creosote plugs the Teredo's cutting teeth and he must rest until a new set grows in. Even though growth is rapid the Teredo is soon stymied and does not get far in life.

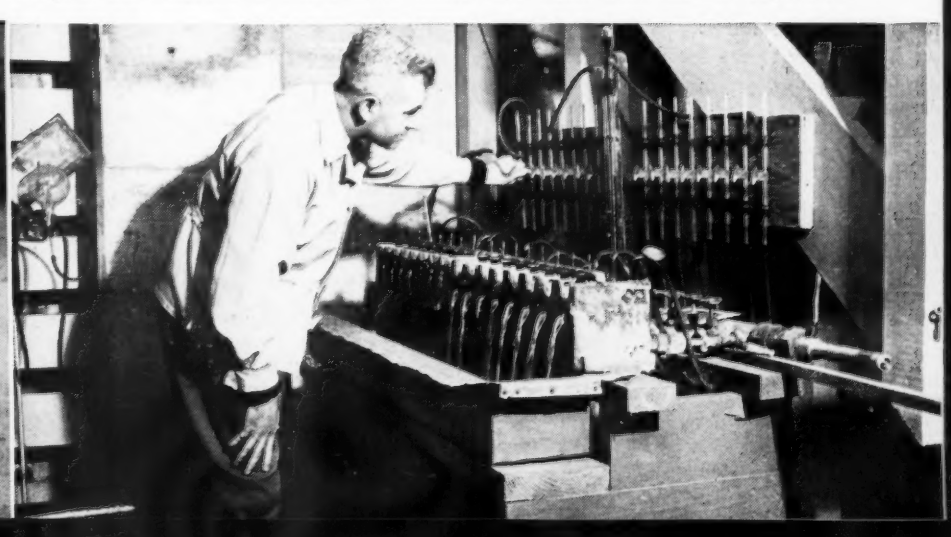
Facilities for atmospheric testing consist of one test rack about 50 ft inland but near enough to shore to subject the samples to heavy spray from wave action, and another about 750 ft inland. All racks face south. Frames are set at an angle of 30 degrees from the horizontal, with the specimens supported and held in place by porcelain insulators to prevent galvanic action between samples and frame.

To gain information on galvanic action between dissimilar metals in contact, numerous panels contain bolted, riveted and welded samples. Job here is to determine best bolt or rivet material to use with various alloys, and whether contact joints must be insulated. In riveted joints, stress-relieving plays an important part in preventing cracking. Effects of atmospheric corrosion are determined by visual observation, weight loss and changes in mechanical properties. A laboratory at the site provides facilities for observing and recording the results for study and comparison.

TESTS EROSIVE EFFECTS of velocity. This disk whirls samples under water

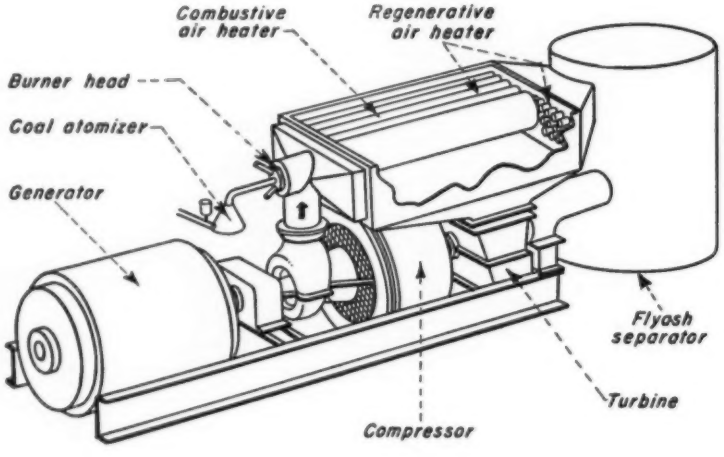


TESTS IMPINGEMENT ACTION of a salt-water jet mixed with air bubbles. Samples are inserted in these cells where the water flow can be regulated

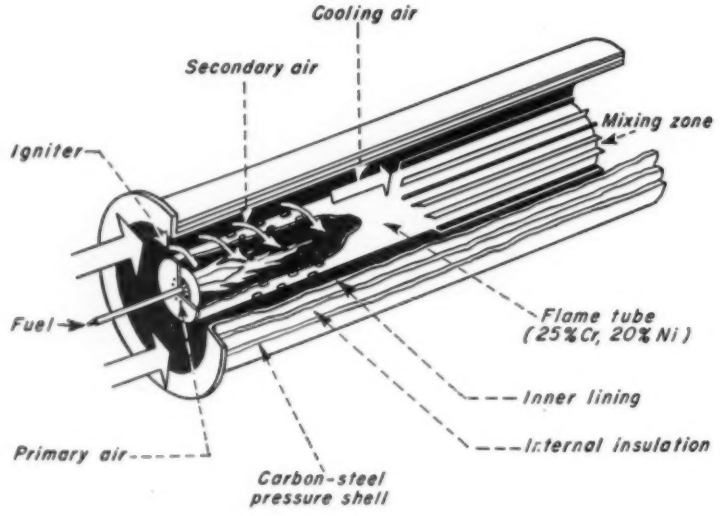


Engineers Report New Developments

Progress in gas-turbine power plants, engineering metallurgy, fuel technology, steam-power economics and operating methods, atomic power and heat pumps is discussed at ASME semi-annual meeting. Here are digests of prime interest to power men



ARRANGEMENT OF COMBUSTIVE AND REGENERATIVE AIR HEATERS FOR COAL-FIRED TURBINE



OPERATING PRINCIPLE OF COMBUSTIVE HEATER

Fig. 1—To conserve space, combustor of coal-fired gas turbine will be put inside regenerator. Combustion air goes direct to flame tube; remainder passes through regenerator tubes, then flows through annular space around flame tube to mix with combustion products at end, reducing temperature to turbine

▶ SIGNIFICANT REPORTS on developments in gas turbines, materials, fuels, power-plant practice, atomic power and heat pumps were presented at the semiannual meeting of the American Society of Mechanical Engineers held in Chicago, June 16-19. Papers of interest to power engineers are digested below; in most cases, copies can be obtained from ASME at 29 West 39th Street, New York 18, N. Y.

GAS TURBINES

The Coal-Fired Gas-Turbine Power Plant, *by John I Yellott and Charles F Kottcamp, Locomotive Development Committee, Bituminous Coal Research, Inc, Baltimore, Md.* Paper reviews reasoning that lead to development of the coal-fired gas-turbine locomotive and the research program that followed. Design of coal-handling and preparation equipment now proposed includes improvements in the method of pressurizing the coal, in the control of coal feed and in the pulverizer. Basic combustion research indicates no radical departures from conventional practice are needed for operation under pressure. For space economy, the combustor will be combined with the regenerator, Fig. 1. Combustion air will enter the flame tube directly while the remaining air will pass through the regenerator tubes, being led back through the annulus around the flame tube. It will serve to "cool" the flame tube and by mixing with the products of combustion at the end of the flame tube will reduce temperature to the 1300 F desired.

Basic research on the effect of ash on turbine blades indicates that with efficient flyash separation no erosion is encountered but, instead, deposits tend to form on the blades. These can be removed by blasting with flyash or by washing, and present indications are that the problem is not a major one.

A large pilot coal-handling and preparation plant is now under test at Dunkirk, N. Y., and a satisfactory 24-hr run has been completed. Work is under way on a full-scale plant at Fontana, Calif., where needed compressed air is available. The two gas-turbine power plants ordered last August are under construction and designs for the two locomotives have been submitted.

The Modern Gas Turbine in the Industrial Power Plant, *by J R Haskin, Jr, Union Electric Co, St. Louis, Mo.* To

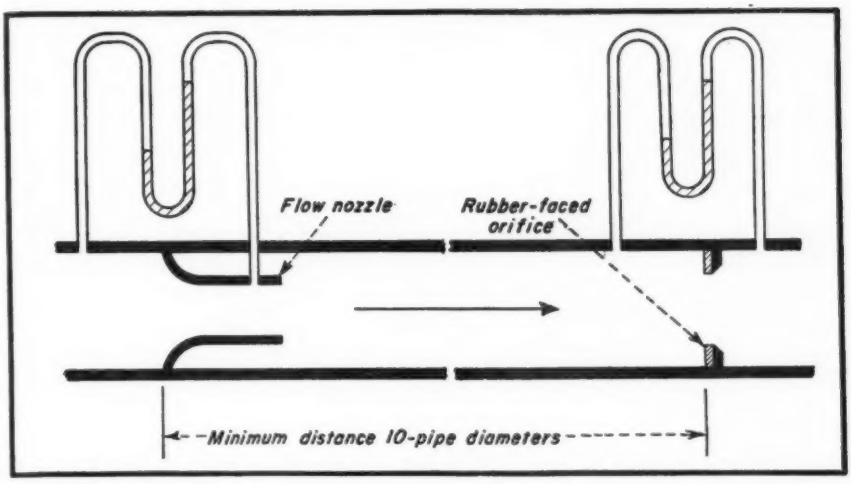


Fig. 2—Combination of nozzle and sharp-edged orifice in stream of air and pulverized coal forms practical device for measuring amount of coal in air

indicate the possible application of gas turbines in plants requiring heat as well as power, the paper analyzes a typical case, showing in some detail the calculations involved in determining the plant performance. Several curves are presented that can be used in making similar estimates for other plants. The author concludes that gas turbines deserve careful consideration for applications of this kind.

Elimination of Waste Products of High Moisture Content in a Gas Turbine, *by J H Potter, John Hopkins University, Baltimore, Md.* Proposes a gas-turbine cycle for use with waste fuels of high moisture content. Turbine exhaust serves as preheated air for a waste-fuel furnace. Products of combustion give up heat to the gas-turbine cycle in a heat exchanger and a separate combustor is provided in the event that sufficient waste-fuel heat is not available to produce desired turbine throttle temperature. Cycle is considered particularly adaptable for producing power from incinerator operation.

Development and Testing of a Gas-Turbine Combustor, *by A E Hershey, Westinghouse Electric Corp, East Pittsburgh, Pa.* Covers in some detail preliminary development and testing of a combustor for a 2200-hp unit, to burn residual fuel oil. Development problems centered around ignition, flame stability, obtaining complete combustion and assuring durability of the combustor parts.

MATERIALS

Precision-Cast Blades for Aviation Gas Turbines, *by P G DeHuff, Westinghouse Electric Corp, South Philadelphia, Pa.* Describes method of producing cast blades with special reference to metallurgical characteristics of the finished product and inspection procedures needed to insure uniform quality. Evaluation of this method indicates substantial inherent advantages and need for further process and metallurgical control development.

High-Temperature Disk-Forging Developments for Aircraft Gas Turbines, *by L B Fonda, General Electric Co, Lynn, Mass.* Bursting tests on 179 turbine-wheel blanks for the I-40 jet engines used in P-80 pursuit planes, and on 6 bucketed wheels, yielded significant data on alloys used and particularly on forging practices. Most important consideration is ductility and the best method of obtaining it is proper control of grain flow. Unsound forgings can be reduced by extreme care in making sound ingots and billets and careful inspection using Zyglo and supersonic methods.

An Investigation of Boiler Drum Steel after Forty Years Service, *by H S Blumberg, M W Kellogg Co, Jersey City, N. J., and G V Smith, U S Steel Corp Research Laboratory, Kearny, N. J.* Describes examination and testing of one complete boiler drum and six separate test specimens from a group of drums removed from Waterside No. 1 station of Consolidated Edison Co of N. Y. These units had been placed in service in 1901 and 1902. Results are given of chemical analyses, tensile, bend, notch-impact and hardness tests, macro- and microscopic examinations, magnaflux inspection and strain-aging tests.

The results: no sign of deterioration or any general corrosion. Caustic embrittlement was clearly absent. Mechanical properties after service are similar to those of present-day materials of similar composition. There is no indication that strain-aging occurred. Careful and regular maintenance undoubtedly contributed much to this good experience. The authors conclude that derating of boiler drums operating under these particular conditions, with careful inspection and maintenance, is not warranted.

FUELS

Meter for Flowing Mixtures of Air and Pulverized Coal, *by H M Carlson, P M Frazier and R B Engdahl, Battelle Memorial Institute, Columbus, Ohio.* If a mixture of pulverized coal and air flows through a nozzle and a sharp-edged orifice in series, it is found that while the nozzle measures the total flow of air plus coal, the presence of finely divided coal in the stream has little influence on the accuracy with which the orifice measures the flow of air alone. This property permits measurement of the amount of coal flowing in, for example, the branches of a pulverized-coal system.

The paper traces development of the meter, presents theories for its operation, and cites performance of laboratory and industrial meters. Within the scope of tests made, pipe size seems to have no effect, but corrections seem necessary for variations in coal fineness and coal-air ratio. Using correction factors, accuracy is within plus or minus 5%. The paper concludes with a sample design calculation for such a meter.

Fluid Devolatilization of Coal for Power-Plant Practice, *by A D Singh, Singh Co, Chicago, Ill., and L J Kane, U. S. Bureau of Mines.* Use as a power-plant fuel of char produced by low-temperature carbonization of bituminous coal offers these advantages: (1) easier pulverization (2) higher combustion rates with shorter flame (3) fuel saving of 4-5% due to lower hydrogen content of char and reduced surface moisture (4) simplified handling, and (5) practical elimination of spontaneous-combustion hazard. Authors discuss past difficulties in economical production of char and describe a promising system embodying such new developments as the fluidization process used in oil refining and the flash pulverizer. The term fluidization refers to the use of finely divided coal in an air stream, which behaves in virtually all respects like a fluid.

Paper describes the devolatilization method, and presents data on results

with a high-ash Illinois coal, showing factors influencing production of char, gas and tar. The authors believe the process fits in well with the new cyclone furnace and with conventional pulverized-coal systems, and offers possibility of substantially reducing atmospheric pollution from power plants.

STEAM POWER

The Economics of Industrial Plants, *by B A Lininger, E I du Pont de Nemours Co, Wilmington, Del.* Beginning with definitions of basic economic terms and viewpoints, the paper cites several cases to clarify the various considerations involved in determining the most economical procedure under different circumstances. Particular stress is put on giving due consideration to such factors as the cost of shutdowns.

Economies in Power-Plant Design, *by E H Krieg, American Gas and Electric Service Corp, New York, N. Y.* Stressing the importance of low first cost and high availability among the various economic factors in plant design, the author outlines a few examples of design economies. Among the suggestions are: adoption of "unit" construction (one boiler, one turbine), use of "standard" turbine-generators, and provisions for insuring high availability.

Specific examples of solutions of design problems are cited: placing large condensers in series at Philo Station to make the most of limited water flow, hanging condensers from turbine exhausts to reduce mounting costs, selection of economic condenser-tube length, choice of pressure and cycle position of deaerators and evaporators, elimination of duplicate heater drip pumps, elimination of boiler stop valve, reduction in cost of main steam piping by placing it in torsion as well as in bending, cutting valve maintenance costs by use of welded-in seats and stellited disks, and many other design changes.

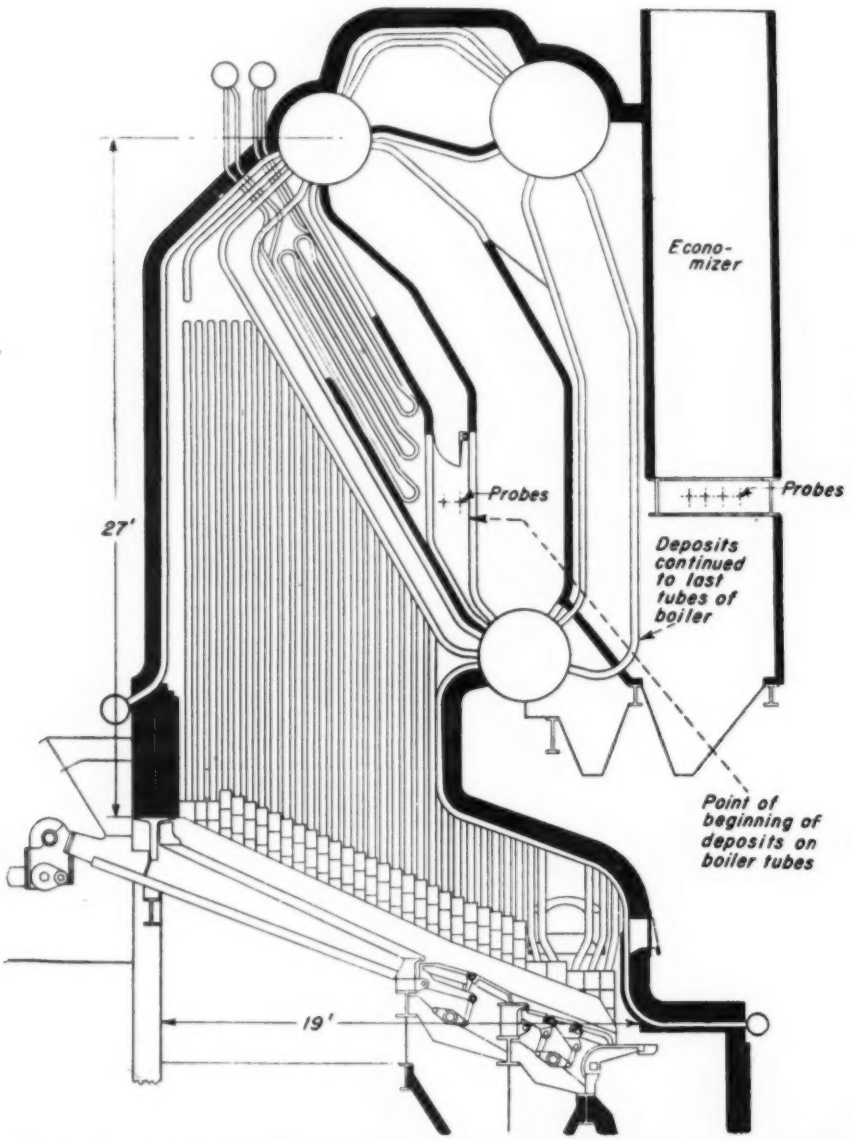


Fig. 3—Cross-section of boiler in which gas-side sulphate deposits were found indicates tube area over which they form, shows location of test probes

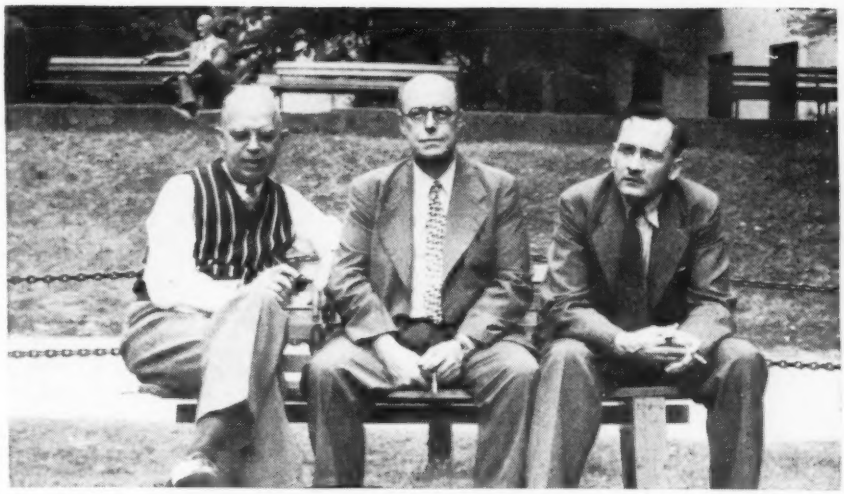
Quick Starting of High-Pressure Steam-Turbine Units, *by J C Falkner, R S Williams and R H Hare, Consolidated Edison Co of N. Y.* Method consists, in essence, of admitting steam to the turbine at a temperature corresponding to that of the main parts of the unit after a shutdown period up to ten hours. This procedure, fully described in the paper, reduces thermal start-up stresses in turbine and boiler, starting-up fuel losses and personnel required, and increases the available reserve factor as compared with conventional methods. Paper presents extensive data on load conditions requiring development of new starting procedure, and experience with it.

Test Data on Gas-Side Sulphate-Type Deposits on Tubes Beyond the Boiler Furnace, *by J F Barkley, L R Burdick and A A Berk, U. S. Bureau of Mines, Washington, D. C.* Accumulation of unusual, dense, troublesome deposits on the gas side of tubes of the boiler in Fig. 3 led to extensive study of their nature and formation. In the course of this work an improved and satisfactory method of analyzing products of combustion for SO_2 and SO_3 was developed. Investigation to date shows the deposits consist largely of sulphates and their formation depends on many factors: gas temperature, quantity, size and chemical analysis of flyash, relative amount of burning of SO_2 to SO_3 and the relative saturation of the moisture and of the sulphurous gases, which depends on the CO_2 carried and the amount of sulphur coming from the coal. Operation with lower CO_2 was found to slow the formation of deposits. The studies are being continued.

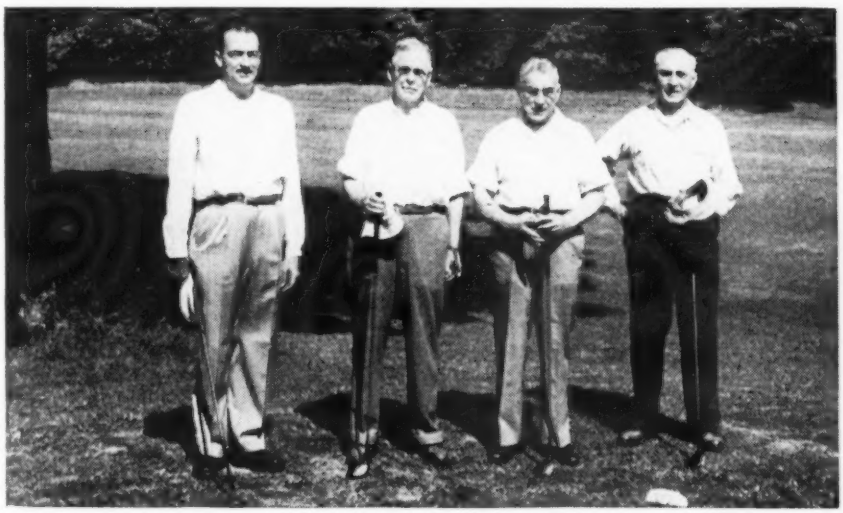
Coal Handling With Earth-Moving Equipment, *by R L Hearn, Hydro-Electric Power Commission of Ontario, and R F Leggett, University of Toronto, Toronto, Ontario, Canada.* Describes special problems solved in layout of coal-handling system for steam power plant of Polymer Corp, Sarnia, Ontario. Use of earth-moving equipment in a flexible storage layout offered substantial advantages, which were demonstrated during two years' operation. Operating statistics and cost figures for the coal-handling operation are given.

(*Continued on page* 156)

The Men Behind Steam

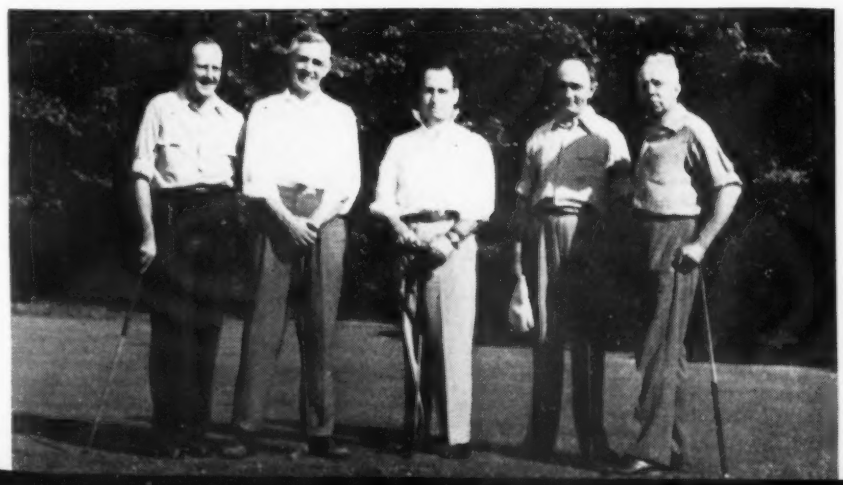


F B Strale, Detroit Stoker Co; E R Stone, Westinghouse Electric Corp; H Stead, E Leonard & Sons, Ltd



E T Knobloch, Union Iron Works; A G Pratt, Babcock & Wilcox Co; F G Brinig, Erie City Iron Works; E F Simon, Ohio Machine & Boiler Co

A P Darlington, Taylor Forge & Pipe Works; W F Woodruff, Hoffman Combustion Engineering Corp; C McClenathan (guest); F Linsenmeyer, Hoffman Combustion Engineering Corp; C Wilson, Jr, Yarnall-Waring Co



▶ FAR MORE THAN HALF of all the kilowatt-hours generated in America stem back to steam. Steam also produces millions of mechanical horsepower in industry, and serves process and heating almost everywhere. In an important sense, then, the steam boiler can be said to be America's most basic prime mover.

Behind boilers everywhere stand the human "prime movers" of steam, the men who build the boilers, firing equipment and steam-generating auxiliaries —key executives of the member companies of the American Boiler Manufacturers Association and Affiliated Industries. Many of these top men behind steam power attended the annual convention of the ABMA & AI at French Lick Springs, Ind., June 15-18. Here they are—an almost* complete array of those at the meeting—pictured for the information of power engineers.

As the name implies, the ABMA & AI is the trade association of companies engaged in the manufacture of power boilers and associated equipment. Canadian companies are included. Active membership is limited to those concerns that make the major elements of steam generating units—boilers proper, the stokers, pulverizers, superheaters and air preheaters.

In general, associate members companies are engaged in the manufacture of boiler accessories and components—such items as safety and blowdown valves, refractories, boiler tubes, water columns and soot blowers.

Also included as associate members are the boiler insurance companies and various service organizations concerned with boiler safety, boiler laws and inspection.

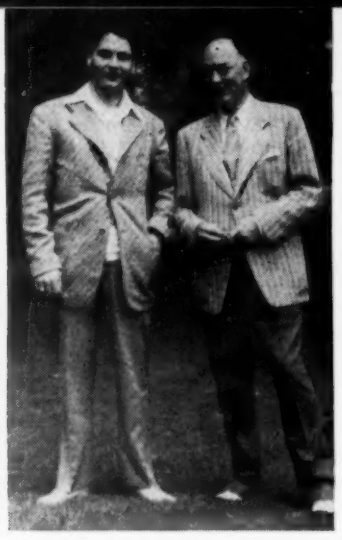
Meeting twice a year to discuss matters of mutual concern, the members and associate members of ABMA & AI also serve the interests of all power men by promoting uniform standards of construction, by supporting research, by cooperating to improve design, and in many other ways.

At the French Lick meeting of 1947, F G Brinig and Raymond J Bros were reelected president and vice-president, respectively. A C Baker was reelected secretary and treasurer. Max Hofman was elected chairman of the associate

* Some of the men at the meeting were not available for photographs.

All captions give names, reading from left to right in the photograph

C D Allen, Waterous, Ltd; H S Marshall, Air Preheater Corp; Pell W Foster, Jr, Foster Wheeler Corp; L J Robb, National Tube Co



J E Bass, Plibrico Jointless Firebrick Co; I S Pieters, Plibrico Jointless Firebrick Co

Philip Sprague, Jr (guest); Miss Ruth Green, Master Reporting Co; Hall T Sprague (guest); Philip T Sprague, Hays Corp

S L Huyette, Paul B Huyette Co; B R Mueller, Pittsburgh Steel Co; J R Brown, Reliance Gauge Column Co

Henry V Heuser, Henry Vogt Machine Co; G A Heuser, Henry Vogt Machine Co; Henry Aldrich, American Boiler & Affiliated Industris (Standard committee)

members. Following is a list of the members and associate members:

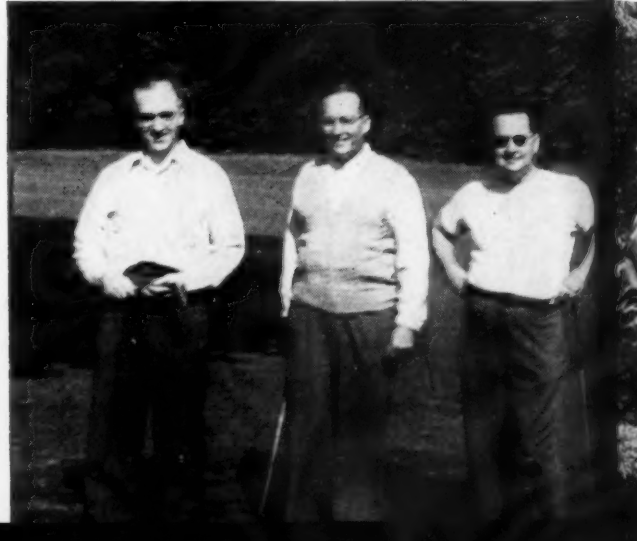
ACTIVE MEMBERS

Air Preheater Corp
William Allen Sons Co
Almy Water Tube Boiler Co
American Engineering Co
Babcock & Wilcox Co
Babcock & Wilcox-Goldie McCulloch, Ltd (Canada)
Bigelow Company, The
Wm Bros Boiler & Mfg Co
Brownell Company, The
Canadian Vickers, Ltd (Canada)
Combustion Eng Co Inc
Combustion Eng Corp, Ltd (Canada)
Detroit Stoker Co
D M Dillon Steam Boiler Works, Inc
Dominion Bridge Co Ltd (Canada)
C H Dutton Co
Edge Moor Iron Works, Inc
Erie City Iron Works
Farrar & Trefts, Inc

(*Please turn the page*)

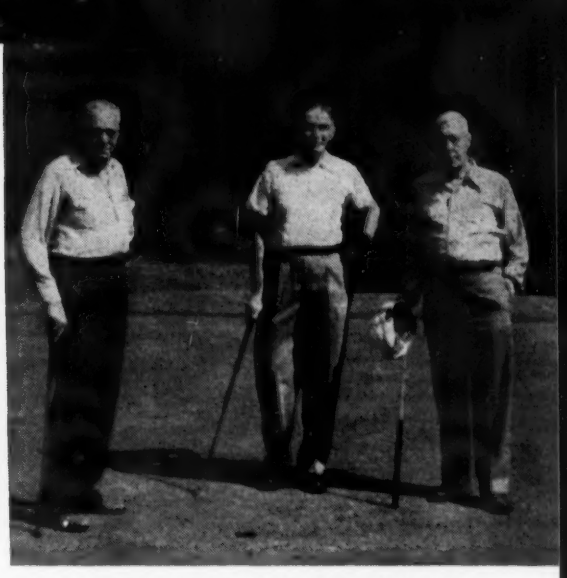
R J Stormont, Wickes Boiler Co; J A Ireland, Steel & Tubes Div, Inc; D M FitzGerald, Wickes Boiler Co; J J I Jamieson, Steel & Tubes Div, Inc

W H Pugsley, Hays Corp; S M Rudolph, Hays Corp; H B Freeman (guest)

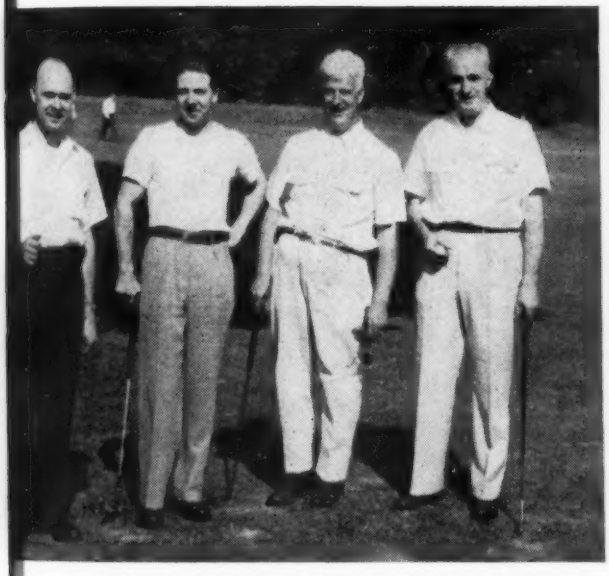


Edward Selden, Erie City Iron Works; H W Hendrix, Strong-Scott Mfg Co; L W Nones, Diamond Power Specialty Corp; A W Strong, Jr, Strong-Scott Mfg Co

S H Barnum, The Bigelow Company



W V Richards, Brownell Co; E L Beckwith, Detroit Stoker Co; Frank Coburn, honorary member



E M Burkhart, McAleenan Brothers Co; Wm Palm, Cyclotherm Corp; J H Forester (guest); Dr W G Theisinger, Luken Steel Co

J S Bennett, American Engineering Co

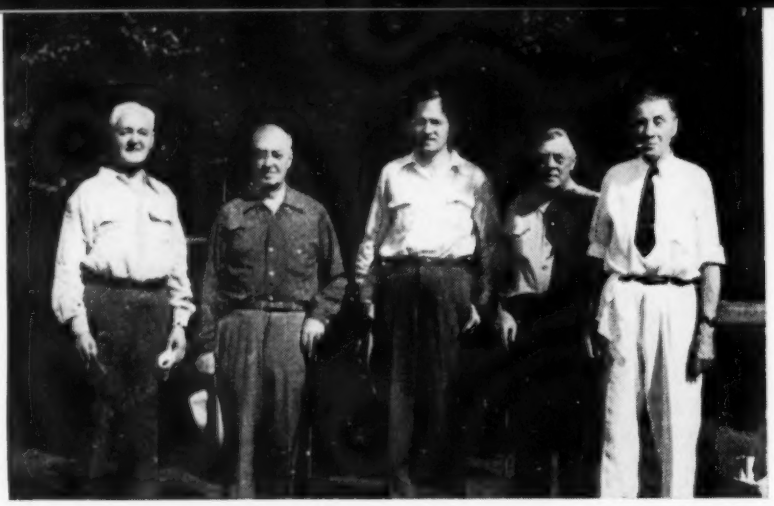
F Locke (guest); W P Heuser, Henry Vogt Machine Co; W Locke, Edge Moor Iron Works; G A Heuser, Henry Vogt Machine Co

L E Griffith, Riley Stoker Corp; A C Weigel, Combustion Engineering Co.

A C Baker, American Boiler Manufacturers Association & Affiliated Industries. W N McCreight, Vulcan Soot Blower Corp.

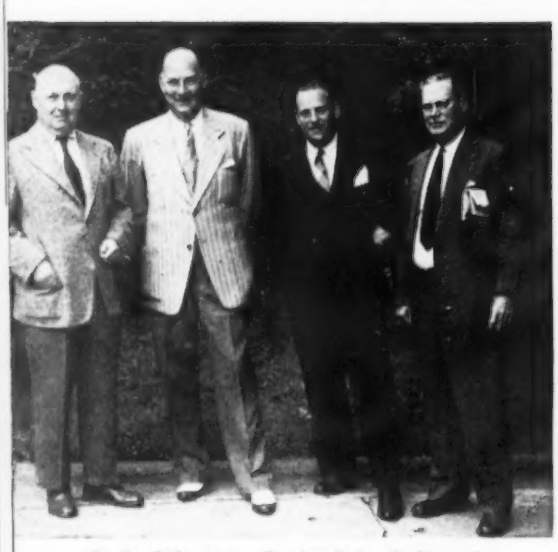
Ed Nick, Northern Equipment Company; H B Freeman (guest)

F H Gordon, Lukens Steel Co

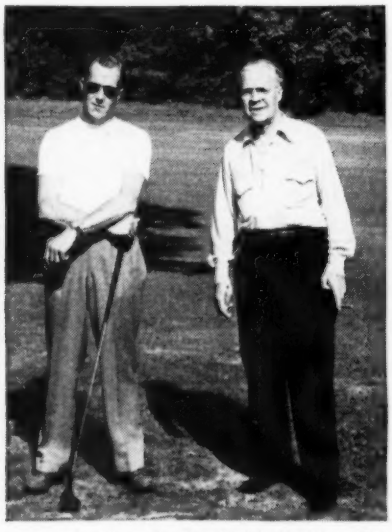


Wm Ferguson, American Uniform Boiler-Law Society; G R McAleenan (honorary member); W G Henderson, Travelers Indemnity Co; C O Myers, National Board of Boiler & Pressure Vessel Inspectors; J P H deWindt, National Bureau of Casualty and Surety Underwriters

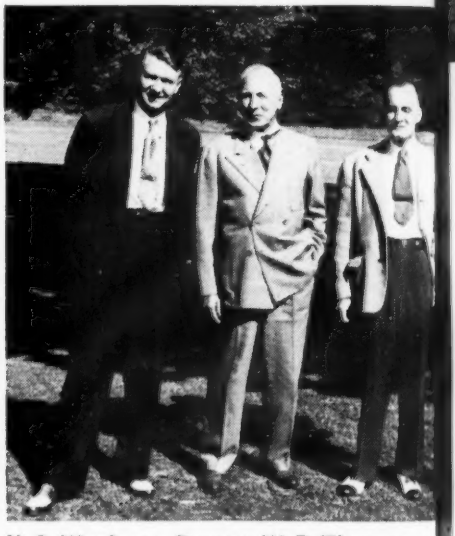
W P Thomas, Diamond Power Specialty Corp; L W Nones, Diamond Power Specialty Corp



G R Atherton, Springfield Boiler Co; I S Pieters, Plibrico Jointless Firebrick Co; L J Robb, National Tube Co; M E Finck, Murray Iron Works Co



Ross Irwin, Springfield Boiler Co; H J Fortier, Foster Engineering Co

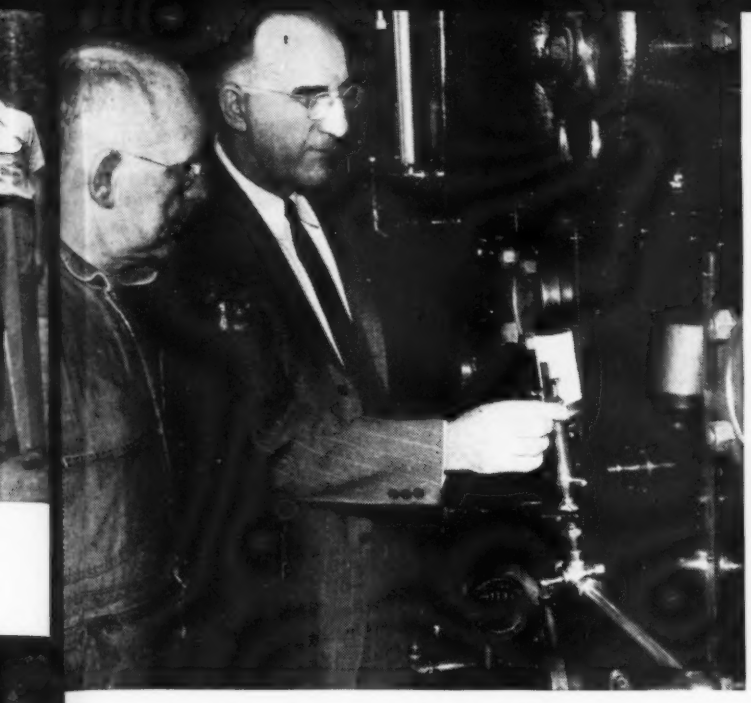


N O Wynkoop, Power; W P Thomas, Diamond Power Specialty Corp; E H Owens, Paul B Huyette Co

Fitzgibbons Boiler Co Inc
Flynn & Emrich Co
Foster Wheeler Corp
Foster Wheeler Ltd (Canada)
Hodge Boiler Works
John Inglis Co, Ltd (Canada)
International Boiler Works Co
International Engrg Works, Inc
Iron Fireman Mfg Co
Johnston & Jennings Co
Kewanee Boiler Corp
Leffel & Co, James
E Leonard & Sons, Ltd (Canada)
McAleenan Bros Co
Murray Iron Works Co
Ohio Machine & Boiler Co
Orr & Sembower, Inc
Portland Co
Prat-Daniel Corp
Riley Stoker Corp
Springfield Boiler Co
Strong-Scott Mfg Co, The
Struthers-Wells Corp
Union Iron Works
Vogt Machine Co, Henry
Waterous, Ltd (Canada)
Westinghouse Electric Corp
Wickes Boiler Co

ASSOCIATE MEMBERS

American Blower Co
American Uniform Boiler-Law Society
Bailey Meter Co
Bayer Co, The
Bethlehem Steel Co
Betz, W H & L D
Buell Engineering Co
Carnegie-Illinois Steel Corp
Champion Rivet Co
Cochrane Corp
Corlett & Co, J F
Crosby Steam Gage & Valve Co
Dampney Co of America
Diamond Power Specialty Corp
Foster Engineering Co
Globe Steel Tubes Co
Hartford Steam Boiler Inspection & Insurance Co
Hays Corp, The
Heacon, Inc
Huyette Co, Inc, Paul B
Lukens Steel Co
Manning, Maxwell & Moore, Inc
National Bureau of Casualty & Surety Underwriters
National Tube Co
Northern Equipment Co
Ocean Accident & Guarantee Corp, Ltd
Pittsburgh Steel Co
Plibrico Jointless Firebrick Co
POWER
Reliance Gauge Column Co
Steel Improvement & Forge Co
Steel & Tubes Div
Taylor Forge & Pipe Works
Travelers Indemnity Co
Vulcan Soot Blower Corp
Western Precipitation Corp
Yarnall-Waring Co



AS A SUPERVISING ENGINEER Frank Smart's ability is apparent just as soon as you step into his power plant

Believer in plant improvements and interchange of engineering ideas—

FRANK SMART

does something about it

▶ BACK IN 1929, Beth Israel Hospital engaged a chief engineer for its brand new building in New York City. It was not long before Chief Frank Smart obtained higher boiler rating and efficiency by redesigning the furnace fronts to direct oil-burner flame near the center. When oil in the boilers became a problem he licked it by building a filter and installing it in the condensate return line. Space does not permit even listing all the improvements he has made, but he is on the beam where engineering is involved as articles in Sept 1940 and March 1941 issues of POWER demonstrate.

As building superintendent, he designed and built such hospital apparatus as oxygen therapy equipment, pavex machines, artificial fever machines, elevator-indicating devices, safety guards for ice cubers, bread slicers, and special X-ray attachments.

Frank is a firm believer in encouraging young engineers to study. Five of his former assistants now hold positions as chief engineers, an indication that his training program gets results. It was through his initiative that he gained his own engineering training, first serving an apprenticeship with the Locomobile Co in Bridgeport, Conn., where he was born and had his early schooling. Later, he served as mechanical inspector foreman with Remington Arms Co, then as chief government inspector of Penn Seaboard Steel Corp of New Haven, Conn.

At the start of World War I he enlisted in the Navy as machinist mate and was sent to the torpedo station at Newport, R. I., where he completed a gunner's course on ordnance and torpedoes. He then saw active service in destroyer service.

After the war, Frank tackled a job with American Machine & Foundry Co, of New York City, as mechanical inspector in the tool-making department. In 1921, he joined the engineering staff of Hotel Astor, New York City, where he served as ice-plant operator, switchboard operator, elevator mechanic, boiler-room engineer, watch engineer, and finally first assistant to the chief engineer. He also found time to attend Cooper Union School of Engineering and Pratt Institute where he studied mechanical engineering. He left the Astor in 1929 for his present job.

Frank has made special studies of power-plant cost accounting and industrial safety, a subject he studied at Columbia University. No serious accident has occurred to an employe under his supervision for 24 years. To his credit are numerous technical articles, and talks to groups on maintenance and safety at Teachers College, in New York City, safety conventions and institution housekeepers' conventions. He has also served on the Hospital Administrators Institute faculty.

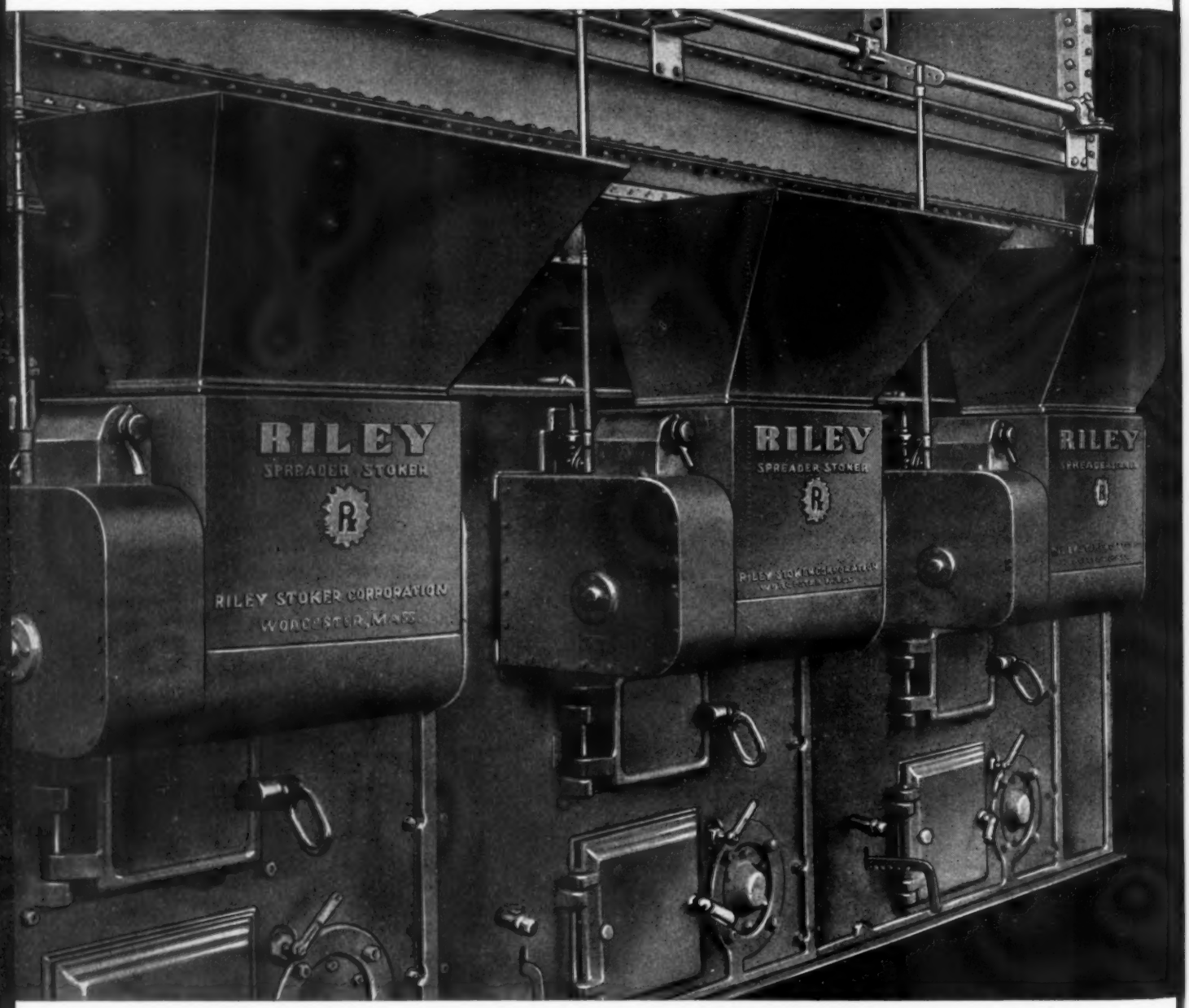
Frank belongs to American Society of Mechanical Engineers and National Association of Power Engineers. An active and hard-working member of NAPE since 1926, he served as president of Greater New York Chapter 1, and as New York State president. He now does important committee work, his latest job being chairman of a committee appointed to rewrite the constitution of NAPE. For this meritorious work, local members gave a testimonial dinner in his honor on April 9, 1947. In 1936 he received the Grimshaw Medal, an award presented by Greater New York Chapter I, NAPE, made possible by a gift of Robert Grimshaw, one of the founders of ASME and first editor of POWER, 1884 to 1886.

A MANY-SIDED MAN

With an active interest in civic affairs, Frank is a member of City Club in Yonkers, a past president of Fleetwood Knoll's Taxpayers Assn, and past master of the Masonic Lodge. For relaxation, he enjoys poker, bridge, bass fishing and puttering in his suburban garden. He says he has a wonderful wife, who has been a great help to him and understands the importance of his attending *legitimate* meetings at night.

Smart is now in the midst of making plans for a new steam generator (combination pulverized-coal and oil fired) and one or more diesel-driven generators to improve plant heat balance. Plans also include air conditioning for nine operating rooms, shockproof X-ray machines and a new nurses' home. A believer in interchange of ideas, he thinks engineering societies should encourage and promote interchange of ideas between operating engineers, designers and architects during the blueprint stage to minimize operating and maintenance problems that are irritating and costly.

low grade Coals are easily handled



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STOKER CORPORATION, WORCESTER, MASS.

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BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

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No Clinker Difficulties

Riley Spreader Stokers will burn the poorer grades of low fusion temperature coals, in a properly designed furnace, efficiently and without clinker difficulties. This is because with the Riley overthrow distributor and adjustable distributor blades very uniform distribution over the entire grate is obtained; because the fine particles of coal are burned in suspension; and because the larger particles of coal are burned on the grate with a comparatively thin, undisturbed fuel bed.

Capable of Burning Wide Range of Coals

While Riley Spreader Stokers afford one of the best and most efficient means of burning low grade midwestern coals, they will also efficiently burn eastern caking coals. With Riley Spreader Stokers you are in a position to burn any available coal which will give you lowest steam costs.

These well-known Companies have ordered Riley Spreader Stokers

OHIO EDISON CO.
(Commonwealth & Southern Corp.)
Akron, Ohio

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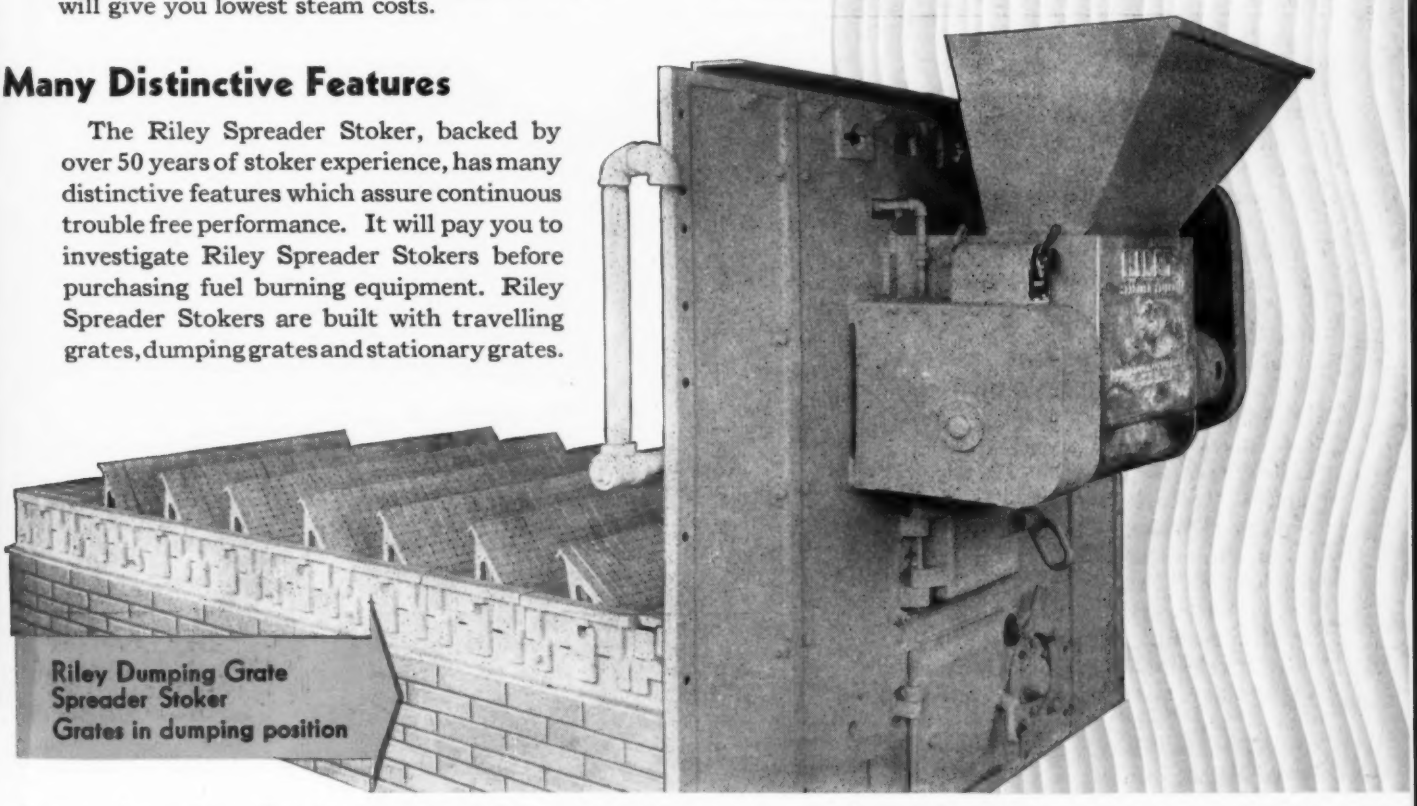

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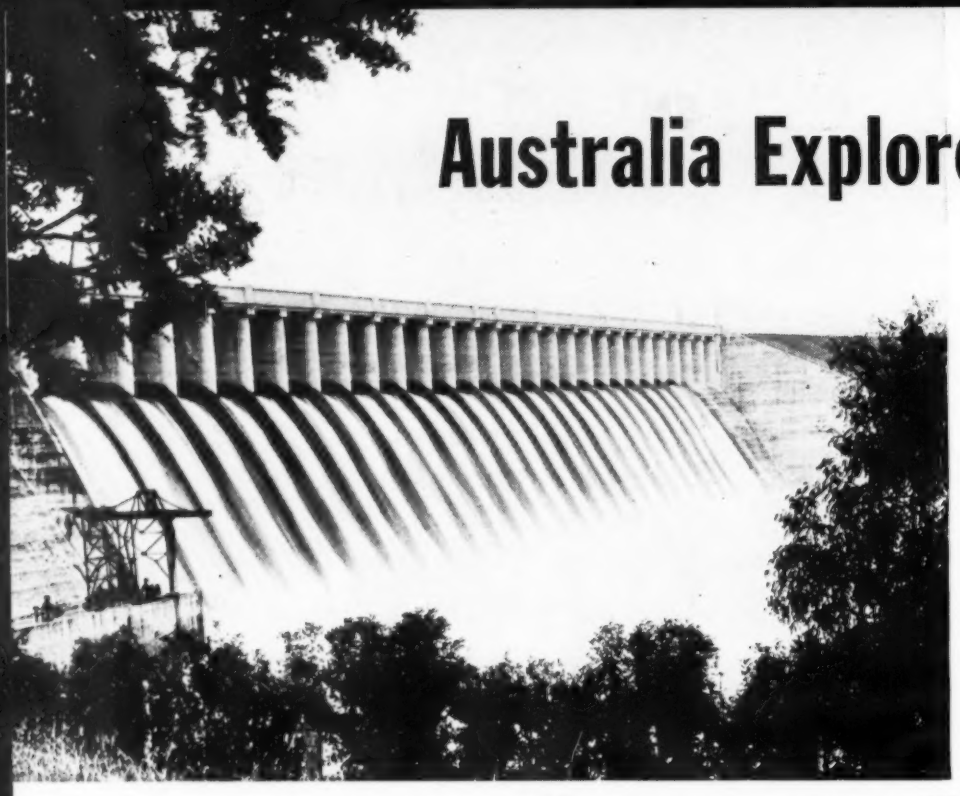
Australia Explores Her Power Potential

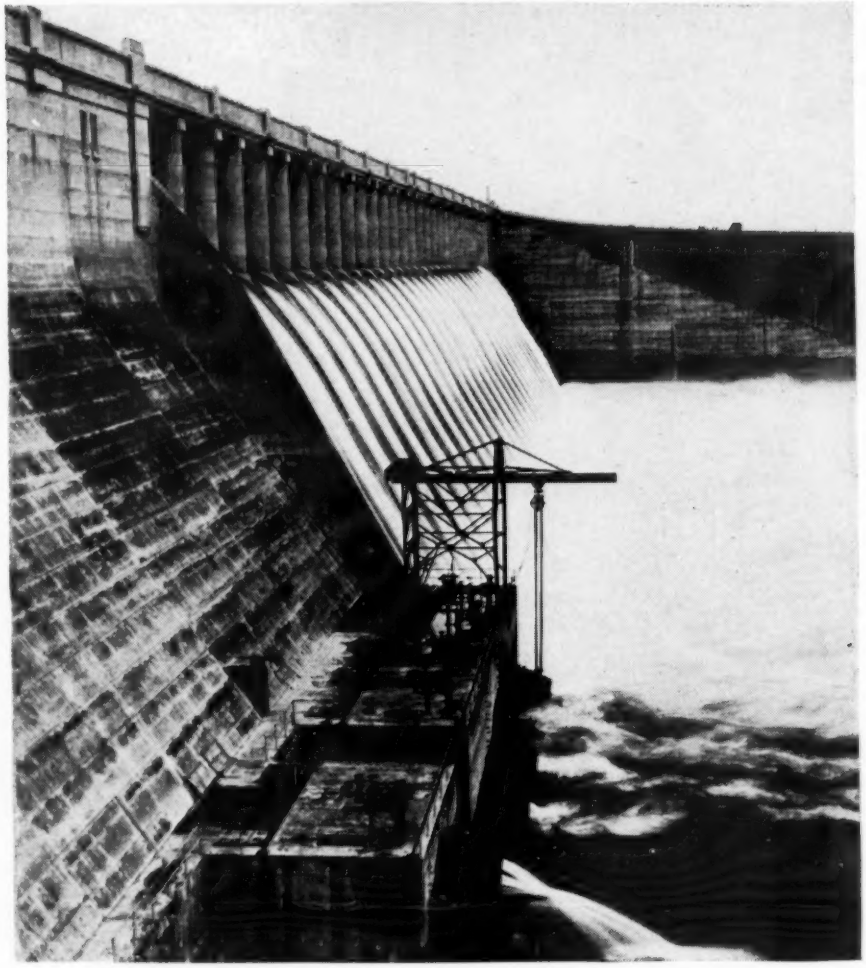


The Hume, left, Australia's largest dam, at the junction of Murray and Mitta Mitta Rivers, stores 1,250,000 acre-ft of water, which drain from 6000-sq mi of mountainous country on the border between Victoria and New South Wales in southeast Australia

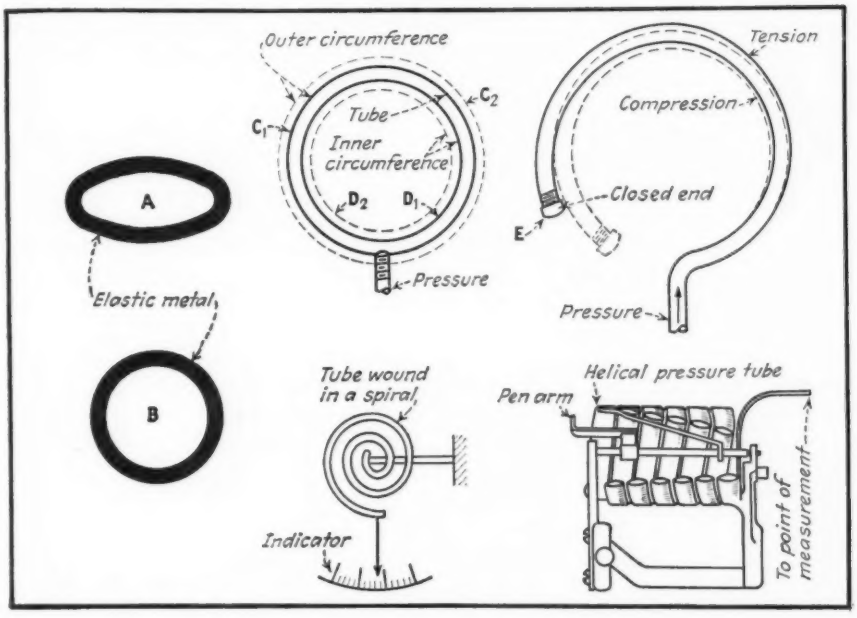
▶ Outside of its southeastern states, Australia lacks ample rainfall for agriculture and industry. Consequently, best use of available water is important in the country's economy. Much has already been done along the 1520-mi Murray River and the 980-mi Murrumbidgee River to use their waters for irrigation and power production. The Hume, shown in the photos, is one of the dams on the Murray River. Of earth and concrete, one mile long, this dam stores 1,250,000 acre-ft of water drained from 6000 sq mi on the mountainous border between Victoria and New South Wales.

Studies are being made on how best to use the Snowy River flow, which can provide nearly 2,000,000 acre-ft of water annually. For irrigation, New South Wales wants 2500 acre ft of water a day, to be diverted by a dam into a 22-mi tunnel leading into the Murrumbidgee River. This project would include installation of 50,000 kw of power-generating equipment.

The state of Victoria also wants the water of the Snowy River for power generation only. A dam would divert water into a 15-mi tunnel to provide an 1850-ft head to generate 250,000 kw. A series of dams on the river's lower reaches can produce an additional 200,000 kw. A third project would utilize the water for both irrigation and power generation; this includes 200,000 kw of power plants.



The Hume includes an earth embankment, 411 ft long, as well as a concrete spillway and outlet section 1042 ft long on the New South Wales side of the Murray. On the Victoria side of the river an earth embankment, 3827 ft long, gives the dam a total length of one mile. Water is discharged through the dam by seven needle valves, each 7 ft, 6 in. in diameter, shown at the lower part in the photo. A Stoney gate at the entrance to each outlet provides an emergency closing for use in case its discharge valve fails or is in need of repairs



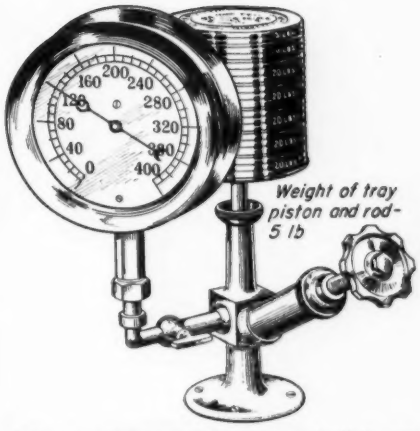


Fig. 1—Dead-weight tester builds up pressure with weights, oil, pump

Fig. 2, left—As pressure builds up in tube A it tends to assume circular shape B, at C_2 and D_2. Resulting tension and compression move E out

For Dependable Readings Test Your Pressure Gages Often

Accurate pressure instruments promote plant safety and perform their part in providing a truthful report of over-all operation. Here are tips on testing, repairing and mounting

By W ELWOOD ROSSNAGEL

Consolidated Edison Co of New York, Inc

►A PRESSURE GAGE indicates liquid, vapor or gas pressure in pounds per square inch (psi) or vacuum in inches of mercury. Behind the glass-covered dial is an oval-shaped hollow metal tube curved to an arc of about 270 deg. One end is anchored and connects to the male threaded stem through a port. Other tube end is sealed and attached to a linkage, gear segment, pinion, or cam and helical shaft, and pointer.

As pressure is built up within the oval tube (known as a Bourdon tube), it tends to assume a more nearly circular cross-section, Fig. 2-*B*. In so doing, the tube straightens slightly, and it is this microscopic movement that moves the pointer around the dial.

Mounting. Because a pressure gage is a sensitive instrument it should never be dropped or laid down carelessly. In service always mount it vertically on the vessel or adjacent piping, preferably on the highest part of the equipment. It is customary to place a stopcock in the piping directly ahead of the gage so it can be readily removed for testing without lowering the vessel pressure. When the vessel contains both liquid and vapor or gas, locate the gage above the liquid level. Always disconnect the gage before hammering a vessel under hydrostatic-pressure test because shock from the hammer blow is transmitted by the liquid and may damage the mechanism.

Range Selection. Always select a pressure gage having a range of about twice operating pressure. In other words, do not use a gage for pressures exceeding one-half the scale range. Under normal operating conditions the hand should be near mid-scale (in the vertical position). If for any reason an overpressure causes the pointer to approach the limit of its travel there is a possibility that the gage will be rendered inaccurate. In such an event recalibrate it.

Accuracy Tests. If conditions justify the installation of a pressure gage, they should warrant keeping it accurate. Therefore, it should be tested at least once a year regardless of the service. When subject to vibration, corrosion, over-pressure, sediment, etc. test more frequently, possibly once a month or a week. If plant personnel are given a little training, the testing can be done without investing much money. So there is little excuse for not keeping pressure gages accurate.

A work bench fitted with ¼-in. copper tubing and supplied with compressed air at a pressure double the highest operating pressure of any vessel in the plant serves for testing. If a small compressor is not available, use bottled air at about 2000 psi. A

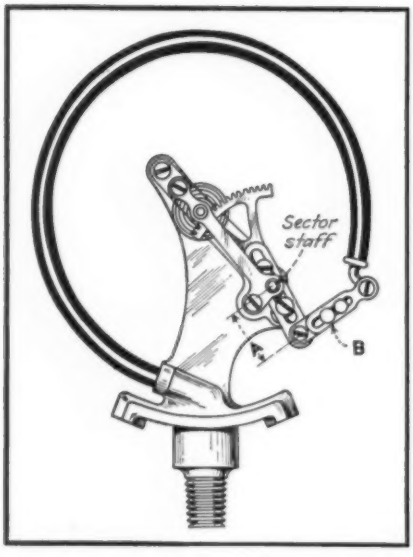


Fig. 3—At link A, adjust pointer travel in relation to tube movement

number of test gages (extremely accurate) each with a petcock below it, should be connected to the test bench, and a needle valve with a 4-in. handle installed on the air-supply line.

A cheaper and more accurate method is to procure a dead-weight tester, Fig. 1, which utilizes lead weights of various sizes, and a small hand pump to build up the required pressure. This method, however, is slower than the test bench.

When a certain pressure gage is to be tested, the inspector or mechanic goes to the location, and after securing permission from the operator in charge, closes the pressure-line stopcock. He then carefully unscrews the gage a thread or two until pressure bleeds off. When the gage is in steam, hot water or acid service, guard against being burned by liquid escaping during removal and transport. When removing the gage, use a wrench on the square base; never unscrew by pulling and pushing on the body.

Readjustment. Screw the gage into position on the test bench, or on a dead-weight tester, noting the readings on this gage when various known pressures are built up. They should agree very closely. If they do not, readjustment is necessary. To do this, take off the glass or plastic front and remove the pointer with a *hand puller*. Finally remove the dial.

If necessary to proceed this far it is worth while to spend a few more minutes and completely service the gage. Take out the movement, piece by piece, dip in trichlorethylene and dry in air, then reassemble. To lubricate the bearings, apply a little powdered graphite with a wooden toothpick or pencil-shaped piece of wood. Never use oil on a gage, particularly if it is to be used for oxygen or high-pressure air service, as spontaneous ignition of the oil may occur.

Before the hand is removed, if it does not just touch the stop pin gently at zero (with zero pressure) but does read accurately at the high end of the scale, or vice versa, adjustments are necessary. If the travel of the hand is too short, reduce dimension *A* in Fig. 3. If it travels too far lengthen this dimension.

By running the gear sector off the pinion, rotate the latter to give the hairspring just enough tension to take up slack in linkage and gears. Link *B* in Fig. 3 is adjusted only as necessary to keep the sector from running off the pinion and to reduce to a minimum the angularity of the sector lever and link.

Check Readings. Replace the dial face and build up pressure on the test gage to exactly half scale. Then press the hand on the shaft so that it reads the same as the test gage. Take readings at four or five points on the dial; zero, ¼, ½, ¾ and full scale. If there are any errors, remove the dial and make further adjustments as described. Final readings should be made at zero, ¼ and ½ scale.

Final Accuracy. For average service an accuracy of plus or minus 1% should be maintained. When the gage is satisfactorily calibrated, mark the date in pencil on the dial and replace the glass. The instrument is now ready for service. Keep a record of the final test, including corresponding readings of both test and tested gage. If major repairs are required, return the gage to the manufacturer.

Future Need for Natural-Gas Substitute

▶ Two sections of a recent staff report on the natural-gas investigation by the Federal Power Commission make some interesting observations on the future of natural-gas supply. They state that "in view of the nation's limited natural-gas resources as compared with coal, it seems certain that some time in the future there will be a need for a replacement gas.

"How rapidly this will materialize is contingent upon future natural-gas discoveries, future consumption of gas fuels and the relative prices of natural and manufactured gas. Meanwhile, the cost of manufacturing gas from coal is far above the price of natural gas.

"The current abundance of natural-gas reserves is probably temporary. Whether it takes ten or twenty years for this situation to change for the worse, the time may be short thereafter to adjust to an alternate fuel, much less to initiate a new industry to take up the development of low-cost manufactured-gas production. There is . . . an almost unlimited and preferential demand for a cheap gas fuel.

"Development of a synthetic fuel gas replacement for natural gas is a project in which many industries may share to their mutual benefit. To the natural-gas industry it means assurance of a future low-cost gas supply, to the petroleum industries a new source of liquid fuels and to the coal industries new and broader markets for lower-grade coals and a better balance generally in the coal utilization economy."

In the use of natural gas in the production of synthetics it "is too early to predict as to how much gas will be required or just what processes will prove to be most feasible. If they are to grow and make the maximum contribution to utilization of natural-gas resources, continuous research and development will be needed. Production of synthetic organic chemicals can prove of great benefit by improving products and creating new and cheaper products. Natural-gas conversion into liquid fuel would provide a beneficial use for natural gas now going to waste, augment supply of liquid fuel and help place gas and oil prices on a corresponding basis."

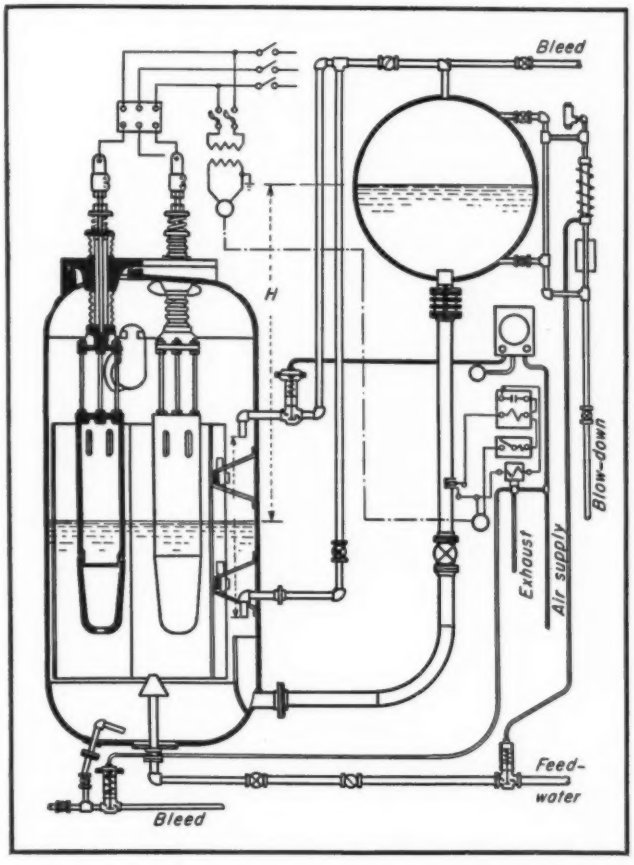


Fig. 1—Three-element electric boiler has independent controls for steam pressure, feedwater flow and boiler-water salt content. They are arranged to maintain operating stability, and minimum lag with a fluctuating steam load

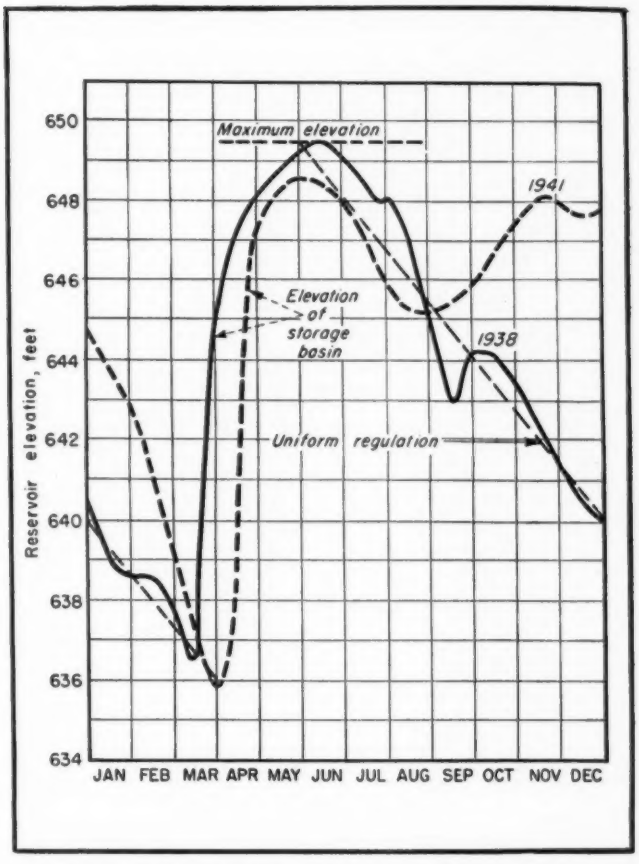


Fig. 2—Use of storage reservoir in Canada's hydro system is shown by elevation variation for two different years. Annual operation depends on load conditions, water availability, and the scheduling of other system reservoirs

Canadian Hydro Practice Reviewed At AIEE's Summer Meeting

Holding their first technical meeting on foreign soil since the war, American Institute of Electrical Engineers gathered in Montreal, June 9-13. From the comprehensive program, here are outlines of five papers on hydro stations, electric boilers, and German wartime experience in utility power stations

▶ At the Mount Royal Hotel, Montreal played host to over 1300 members of AIEE. In the impressive program of over 100 technical papers, the group devoted to hydro-station practices was particularly appropriate since Canada produces nearly all its electrical energy from water power. Many other subjects were included in the five-day program.

Hydro-Electric Power Development in Quebec, by F L Lawton, Aluminum Co of Canada. Paper 47-124.

Reviewed are history, present status and operating experience of hydro stations and interconnections in the Province of Quebec. The 4,000,000-hp Montreal-Shawinigan-Saguenay interconnected system does not have a single steam station included with its plants.

As of Jan 1, 1946, a total of 5,848,572 hp was developed in the province compared to a total potential and developed, estimated at 13,073,000 hp. Quebec now has 57% of total Canadian hydropower developments Principal reliance has been placed on storage for optimum power development on a given river. Interconnection with other river systems is next in importance. Developed water-power sites fall into major groupings according to the river on which they are situated: (1) Gatineau (2) Lievre (3) Ottawa (4) Saguenay (5) St. Lawrence (6) St. Maurice.

Outstanding features of various plants are noted. At Shipshaw No. 1 a precast dam or obelisk, built on end, was blasted into place to effect final closure

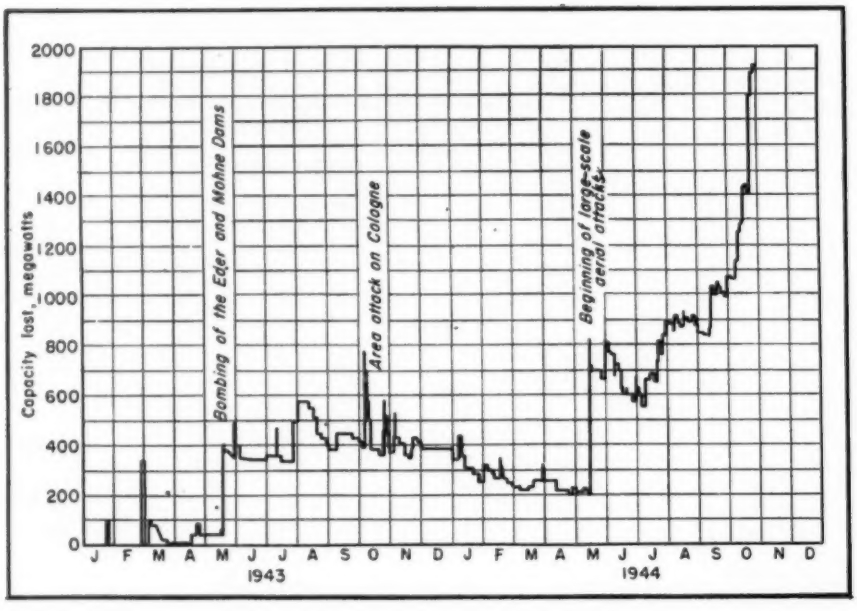


Fig. 3—German generating-station capacity loss caused by war action increased rapidly after May 1944. Official records ceased after Oct 1944 but estimates show total loss at war's end of 5000 to 6000 mw, out of 13,300 mw installed

of the cofferdam across the river channel. Shipshaw No. 2, with a total capacity of 1,200,000 hp, was built completely in 2 years and 7 months. The first unit went into service within 18 months of initial construction. Beauharnois station on the St. Lawrence River at present has 13 units totaling 689,000 hp. Ultimately this plant will take the total flow of the St. Lawrence to develop 2,000,000 hp.

In addition to the general industrial, commercial and domestic loads in Montreal, Ottawa, Quebec, Three Rivers and other city areas the extensive water-power developments are attributable also to the rise in newsprint and associated manufactures; in the Saguenay area, to aluminum production as well.

Factors in the Economic Supply of Energy in Hydroelectric Systems, by A H Frampton and G D Floyd, Hydro-Electric Power Commission of Ontario. Paper 47-168.

A review of all considerations that must be analyzed in planning installations of hydroelectric stations. These fall under the headings of (1) design (2) operation (3) load.

Design considerations include stream-flow control to meet load variations by means of storage works. These depend on availability of storage sites and on riparian rights held by others. When the system has thermal plants also, flow control may be less important and hydro plants may approach run-of-river characteristics. The installation will be controlled by comparison of increment costs with those of thermal plants. In individual plants, turbine and water-passage efficiencies play an important part in final design.

In operation, unit- and plant-load schedules should be planned to generate output at maximum efficiency possible and make most effective use of available water storage. Unit outages must be scheduled to meet variations in load. Automatic frequency control may tend to reduce generating efficiency.

Economic energy utilization is affected by power contracts, recognizing inherent characteristics of hydroelectric development. Interruptible contracts provide reserve capacity against emergencies, reducing peak load but not firm energy generation. Water heating and other off-peak services have particular advantages in matching load factors of demand and source. Secondary energy available seasonally can be sold where markets are available and help reduce firm power costs. Such power can be sold where fuel consumption is replaceable as in the system, or interconnected systems, or in customers' plants with electric boilers.

Maintenance of Hydro-Electric Generating Units, by A S Robertson and R O Standing, Hydro-Electric Power Commission of Ontario. Paper 47-120.

Relates a series of repair problems and how they were solved. These repairs were undertaken at the plant site using available tools and equipment improvised for the job.

The Ontario Power plant has been flooded twice by rise in tailwater level, once in 1909 and again in 1938. In drying out the eight more modern units by conventional circulation of short-circuit current plus force-heated-air circulation, it was accidentally discovered that the drying-out cycle was materially accelerated by heating up to 90 C for 24 hr, and then rapidly cooling to room temperature. With this method the units were progressively returned to service over a seven months' period. Seven older units were dried out by building special housing for the units and applying vacuum drying. All units were operating again within nine months of flooding.

In the Toronto power plant seven small units had recently developed cracked shafts, two failing in service. These were all repaired by welding at the plant. Heat treatment for stress-relieving was supplied by electric heaters, improvised by plant personnel.

Also described in detail in this paper is the method used to remove and repair the main generator shaft of a 55,000-kva unit, and the operation, installation and maintenance of large thrust bearings.

Automatic Operation of Electric Boilers by M Eaton, Shawinigan chemicals, Limited. Paper 47-129.

Of the 2,000,000 kw of electric-boiler capacity in Canada, more than 80% is manually controlled. This paper reviews early methods for automatic regulation of electric boilers, and describes later improvements.

Detailed descriptions of air-operated controllers and examples of application are given. Related problems and methods of conductivity control, water-level regulation, surge-tank control are discussed.

The German Electrical Utility Industry During World War II, by J G Noest, Consolidated Edison Co of New York. Paper 47-135.

The German electrical utilities did not succeed in nationwide interconnected operation mainly because of technical limitations. Germany entered the war with a percentage of spare capacity identical to that of the U. S. A., but she began to experience shortages as early as 1940. Except for rapid air-circuit-breaker development the design and construction of plant facilities proceeded along lines similar to those in the U. S. A. but with somewhat less regard for reliability.

Although the German utilities were never a primary target for aerial assault they suffered considerable damage from aerial warfare. Collapse of the electrical utility system was coincidental rather than contributory to the general industrial collapse at the war's end.

THE OPERATING ENGINEER

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Plant Saves Fuel by Burning Waste Hemp

C Brooks Hudson, chief power engineer, Plymouth Cordage Co, describes his successful system of disposing of waste

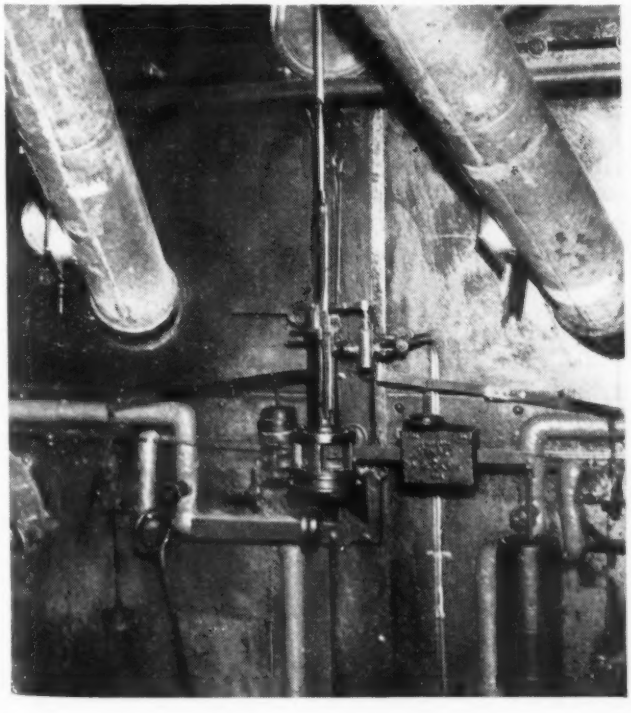
▶ INHERENT IN THE MANUFACTURING PROCESSES of many plants is the problem of waste disposal. Making hemp products, such as rope and twine, is no exception. Here's how careful analysis and evaluation of such waste disposal has turned it from a liability into an asset, resulting in substantial savings. The nature of our waste is fibrous, mostly fine lint mixed with some longer fiber. Compared to weight, the bulk is large. The material is highly inflammable because of the treatment of raw fiber in process. The waste is not adaptable to salvage as a byproduct, but its high heat value per pound suggested its use as fuel under the plant boilers.

Before 1920, we gathered the waste in large fiber containers, which were transported to a central point in each mill. Here it was loaded on small industrial railway cars and pushed by hand to the boilerhouse. It was then hand fired under two hrt boilers.

We kept no figures on the cost of this method of handling waste material, from source to boilerhouse, but boiler-room cost of burning the waste was about $100 a week. With this method of burning, boiler efficiency was low.

Mechanical Handling. In 1921, we decided to experiment with mechanical handling of waste between mill and boiler room. Accordingly, a small fan and dust collector were connected to a boiler furnace through the front wall. This arrangement was successful from the start, so we made a larger and more permanent installation, which takes care of all waste direct from mills to furnace.

The system, modernized in 1931, was installed in a new boiler room built adjacent to the generating plant in the same year. This boiler room has four 5000-sq-ft watertube boilers and four of the old hrt boilers in reserve. The watertube boilers were originally set to burn oil, but two are now equipped with single-retort side-dump stokers in-



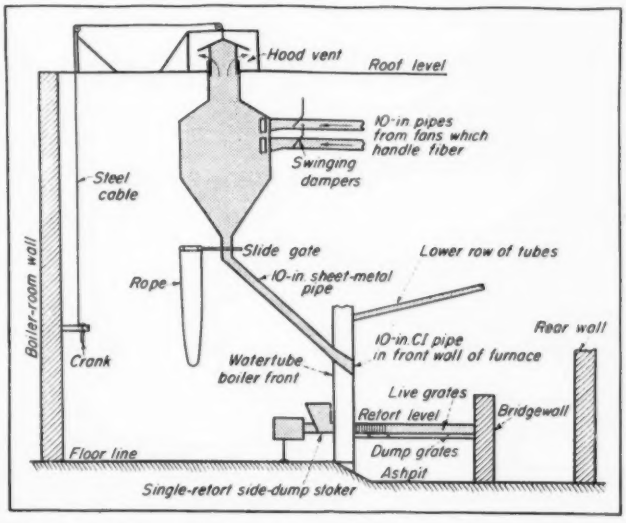
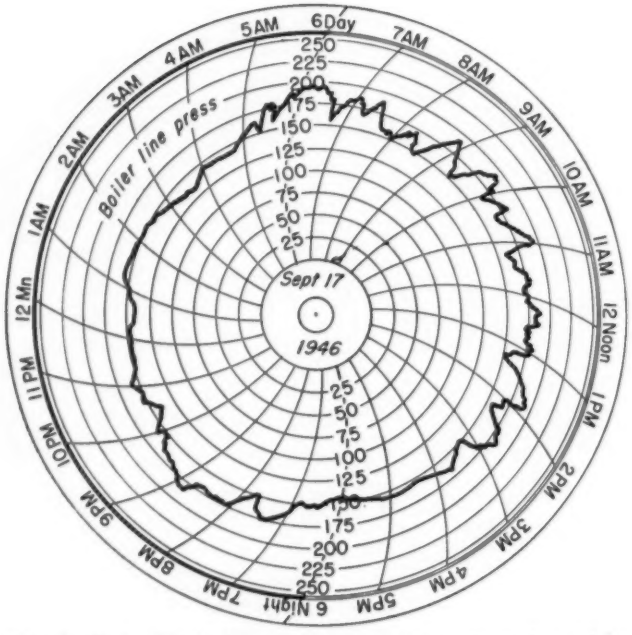


Fig. 1, above—Waste hemp collector with feed pipes, hopper, delivery tubes and sliding gate at the hopper

Fig. 2—Damper regulator and combustion-control device mounted on boiler front between two waste-burning feed pipes. Each pipe feeds waste hemp into firebox above fire



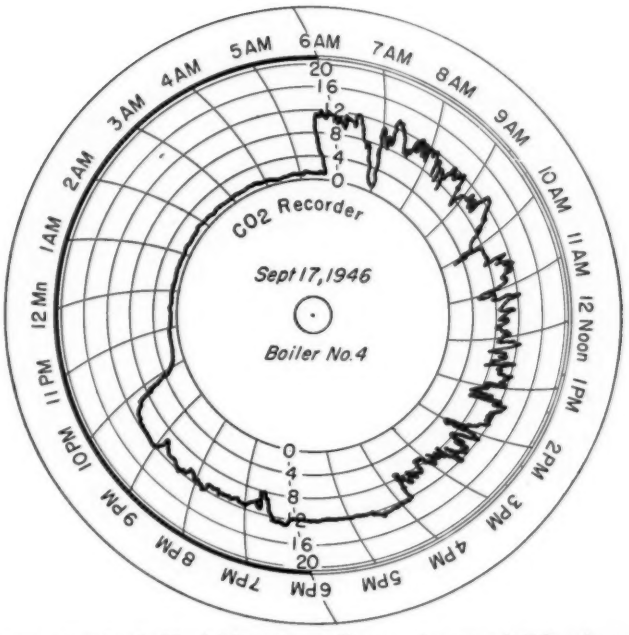


Fig. 3—This chart shows steam pressure on a day when no power was generated and only a small amount of steam was required. Variable steam line and ragged CO_2 show extreme variation when practically all the fuel was hemp

stalled during the war fuel shortage.

Sources of Fiber. We have two sources of waste fiber, several hundred feet apart and at a considerable distance from the boiler room. Each system has a separate fan and pipe installation but both can feed into either of two collectors at the same time. One collector serves two boilers. Suitable switches installed in the piping system enable the boiler operator to deliver waste from either system to either collector. Fig. 1 shows a layout of one collector and waste-handling system for coal-fired boilers.

Normal method delivers all material to one collector, depending upon which battery of boilers is in operation. Switches are also provided at collector outlets so that a collector can serve either of its two boilers.

Firing the Boilers. Delivery to the two oil-fired boilers, Fig. 2, is at a somewhat lower point than the coal-fired units, and discharges direct to bottom of furnace. In both installations most of the waste burns in suspension directly off the end of the cast-iron pipe in the front wall.

Ash from the waste is small and offers no problem at all on the stokers as it discharges with the coal ash. Most of the hemp ash in the oil-fired furnace melts and remains on the furnace bottom. On cooling, it becomes hard. This necessitates its removal by pick, bar and hammer at regular intervals.

A sliding gate near the collector outlet, Fig. 1, is manipulated by small ropes from the boiler-room floor. It is closed when system is not operating to prevent air entering the furnace and fire getting into the collector and the mill. This precaution is necessary as some inflammable dust is always present on the sides of collector and pipes. For fire prevention, two standard sprinkler heads are installed inside the collector, near the top. Although the material is very inflammable we have lost sprinkler heads only three or four times in 25 years.

A pushbutton and bell connect between the supply source and the boiler room. This serves as a signal system for controlling operations. Close cooperation between mill operators and firemen makes an important contribution to successful operation of system.

Over the past ten years the quantity of fiber burned per year has averaged the equivalent of 720 tons of coal at 14,500 Btu per pound, or about 141,000 gallons of fuel oil per year. This amounts to a saving of about $7000 per year with oil at 5c per gallon.

Combustion Control. The rate of feeding hemp waste from the mill, which is entirely dependent on mill operations, is at times quite variable. Therefore some means of automatically regulating the fuel-oil supply to the furnaces is imperative if uniform steam pressure is to be maintained.

Since we had a good damper regulator, we decided to build the combustion control device shown in Fig. 2 and 4. Damper arm C Fig. 4, was welded up from ½-in. bar stock. Suitable blocks welded at each end carried the ends of the fine thread screw and provided a fulcrum at the shaft. The arm is free to rotate on this shaft when the handwheel, which operates the worm, is turned.

Since the worm wheel is fixed to the shaft, turning the worm results in moving the damper rod up or down to locate the required minimum point of closure. This point, of course, varies with the

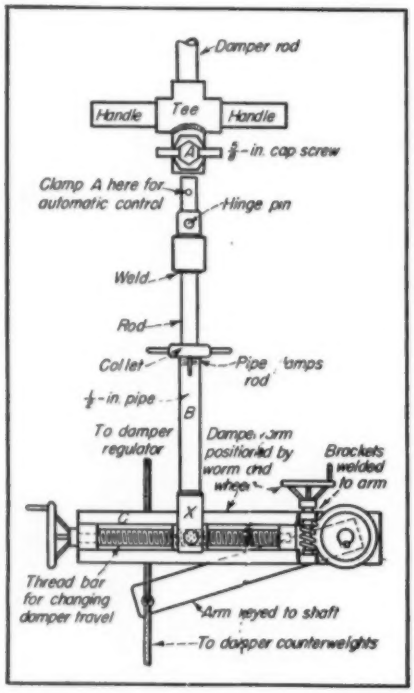


Fig. 4—Combustion control and damper regulator for the waste burner

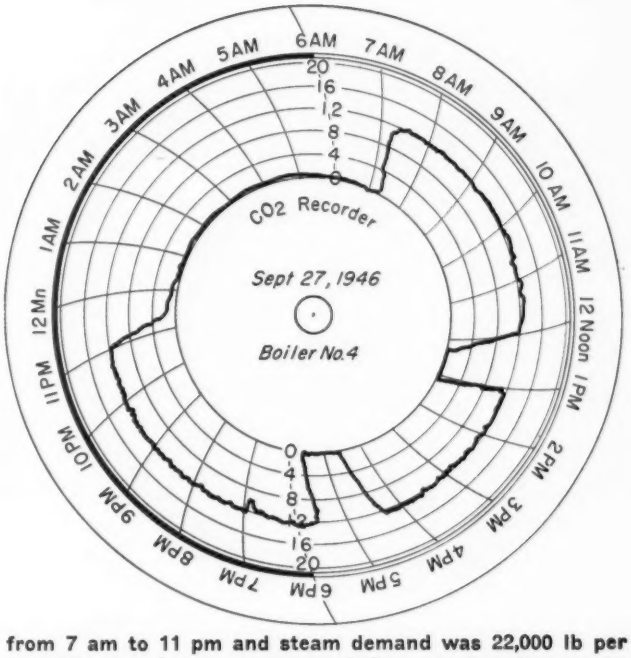


Fig. 5—This steam chart shows effect of burning waste hemp on pressure variation when power was generated from 7 am to 11 pm and steam demand was 22,000 lb per hr. CO_2 remains constant on boiler not burning waste.

number and size of oil burners in use on a given boiler. The travel length of the damper rod is adjusted by turning the handwheel, which operates the thread bar. This moves the block *X* closer and farther from the fulcrum on the shaft, resulting in a shorter or longer arm.

The worms, gears and handwheels were salvaged from old mill equipment. The remaining parts were made from pipe fittings and cold rolled stock with the exception of the collet, which was forged in the machine shop.

Oil Control. The oil-regulating valve was made from a ⅜-in. globe valve, as shown in Fig. 6. An extension was welded to the stem of the valve to take the small cable drum and the spur gear. which is fastened to the drum. The same regulator operates the valve and the damper. The fuel valve can be operated as a hand valve by raising the dog to disengage it from the gear.

A pressure gage is connected in the oil line between the regulating valve and the burners to indicate the pressure adjustment. A pressure of 125 psi is maintained on the pump side of regulating valve. Adjustment of pressure on the burner side is accomplished by allowing the damper regulator to travel to its highest point. The dog is disengaged from the gear teeth, and the valve closed until the desired minimum pressure at the burners is reached. The dog is then reengaged with the gear teeth at the new point.

In this manner we can regulate pressure between maximum and minimum positions from 125 psi down to about 50, which is as low as the burners will atomize satisfactorily. This adjustment also varies the quantity of oil delivered to the burners to suit size and number in use.

Differential between the long travel of the regulator piston and the short travel required for operating the oil-regulating valve is obtained by a notched lever, pivoted on the boiler front, with the free end attached to the regulator piston, Fig. 6.

A clevis, on the regulator end of the cable, operates the oil valve. Sliding this clevis closer to or farther from the fulcrum varies the travel of the oil-regulating valve.

Automatic Operation. Each boiler is fitted with a differential draft gage, flue-gas thermometer and CO_2 recorder. A recording pressure gage shows the line pressure, and a recording thermometer shows the feedwater temperature into and out of heater.

The Sept 17, 1946 charts, Fig. 3, were taken on a day when no power was generated and only one boiler was operating. Up to 3:30 pm, practically all fuel burned was hemp waste; in the remaining time the fuel was oil.

Steam demand, though small, was constant. Variable steam line and the ragged CO_2 clearly show the extreme variation in hemp-waste feed through the day.

About 3:30 pm, waste fuel ceased, and from then until 10 pm all fuel was oil. Although there is a wide variation in steam pressure the flue temperature and CO_2 were fairly constant during this time when the control device was in operation.

The second set of charts, Fig. 5, were taken on Sept 27, 1946, when power was generated from 8 am to 11 pm. Boiler was generating about 22,000 lb of steam per hr.

The pressure-recording chart again shows the effect of variation of waste-fuel feed, which was being burned at the time.

The homemade control has amply justified its construction. Our records show that any plant with a few thousand dollars per year fuel value in its process waste will do well to consider carefully the best disposal method.

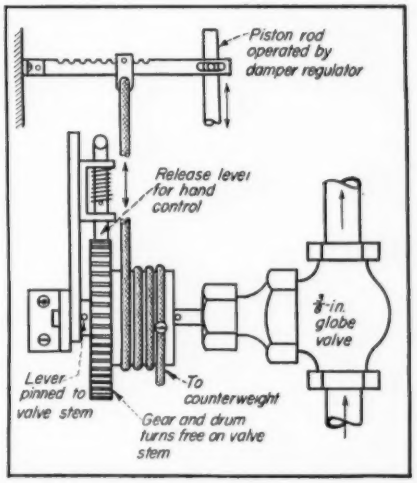
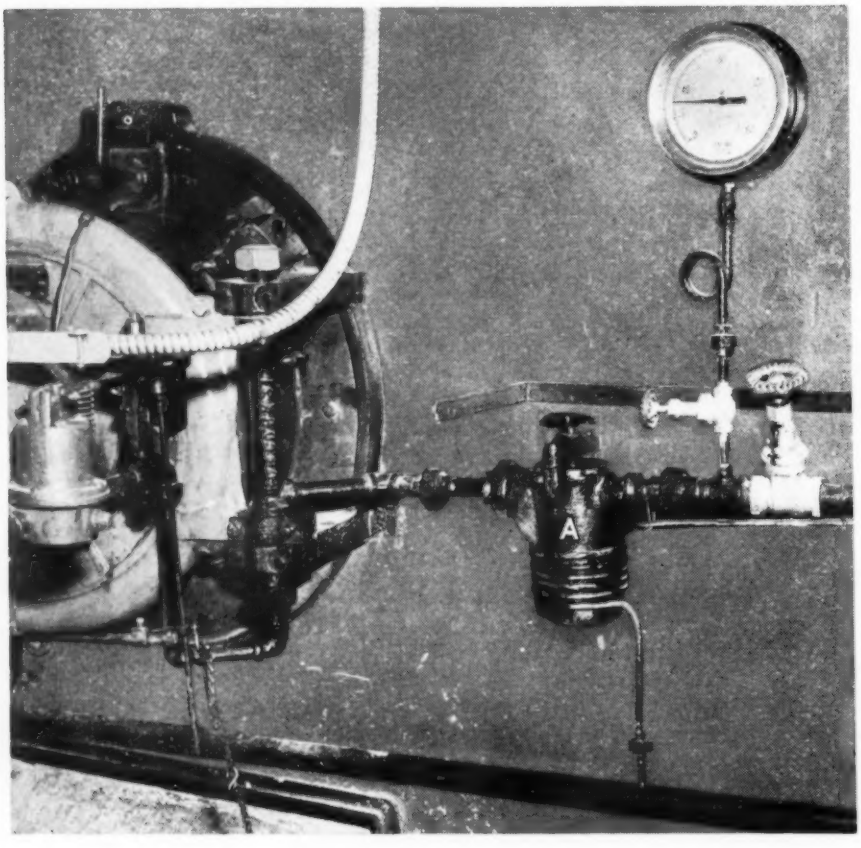

Piston rod operated by damper regulator
Release lever for hand control
⅜-in. globe valve
To counterweight
Lever pinned to valve stem
Gear and drum turns free on valve stem

Fig. 6—Oil-regulating valve built as a part of the combustion control

PRACTICAL AIDS TO OPERATION

Plant-Tested Methods and Ideas for Power Men



HEATING COIL SPEEDS OIL BURNER'S START

OUR THREE BOILERS burn oil. Boiler No. 3 is closest to the oil heaters, so we have had no trouble because of low oil temperature when starting it after a shutdown. No. 1 is farthest from the oil heaters, and when it is down for a time the oil cools in the pipe to the burner. As a result, when starting we may have to watch the burner carefully for several minutes until the oil gets properly heated.

To eliminate this difficulty by keeping the oil correctly heated while the burner is shut off, I wrapped the oil filter with $\frac{1}{8}$-in. copper tubing to form a coil as at *A* in the photo. One end of this coil connects to the steam line and the other to a condensate return line.

When the burner is shut off I crack a valve in the coil connection to the steam line. A small steam flow through the coil keeps the filter and inlet oil line hot. When we start the burner the oil is sufficiently hot for good operation, so we shut the steam off the heating coil. This little kink permits satisfactory firing of the boiler quickly after a shutdown, such as occurs during light-load periods.

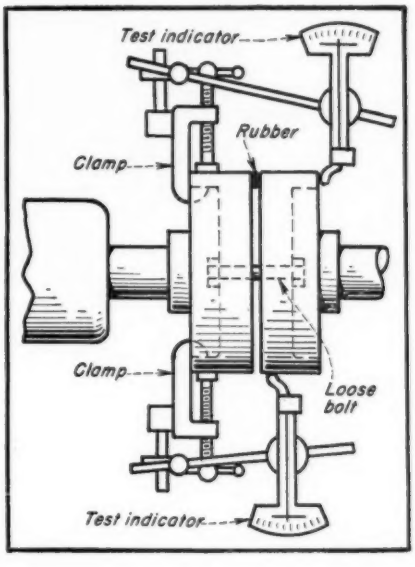
Brooklyn, N. Y. J P CAREY

Two Indicators Check Coupling Alignment

METHOD FOR ALIGNING one machine with another depends on the equipment available for the job, the ingenuity of engineer or mechanic, and the complications encountered. When they are available, test indicators can be used to good advantage, and when correctly applied permit a high degree of alignment accuracy.

For several years I have used two test indicators, mounted 180 deg apart on the same coupling half to check simultaneously parallel and angular alignment, as in the figure. One indicator's contact rests against the vertical face of the other coupling half, and the second indicator's contact rests on its circumference.

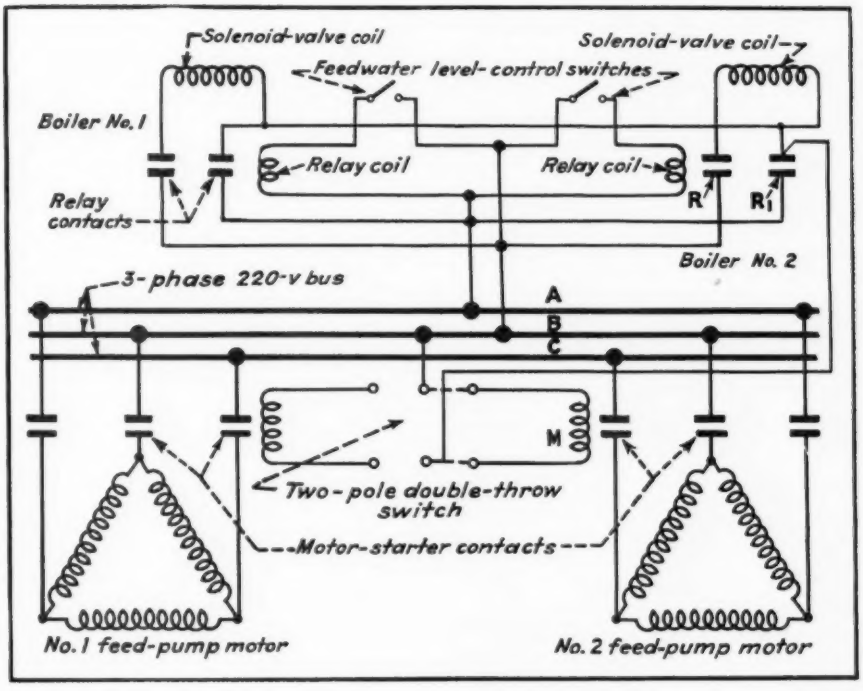
End play between the coupling halves is taken out by inserting a piece of rubber between them as shown. This rubber must be rigid enough to withstand any tendency that the two rotors may have to float together. On the other hand, the rubber must not restrict coupling movement because of misalignment of its halves.



Loosely insert a bolt in the coupling so the halves rotate together. Then when the rotor is turned slowly the indicators will read total misalignment of shaft centers and coupling faces. Be sure that the shaft-bearing shoulders are true to avoid an error in indicator readings, that later may cause serious operating trouble.

RICHARD NANNI
St. Clair Shores, Mich.

Boiler-Water Level Controls Feed Pumps



RECENTLY I DESIGNED AND INSTALLED an electrical feedwater control system on two low-pressure boilers. The problem was to arrange the electrical circuits so a feedwater-level-actuated limit switch on either boiler would start or stop either one of two motor-driven feed pumps, and open or close a solenoid-operated valve in the feedwater line. The diagram shows how I did the job.

The 2-pole double-throw switch permits connecting either feed pump into the system. Assume that it is closed to the right to connect No. 2 feed-pump motor to the system. When water in either boiler drops to a predetermined level, its water-level control switch closes. Assume No. 2 boiler switch closes. This completes a circuit from *A* power line through the relay coil and control switch back to *B* line.

Relay contacts R and R_1 close and complete the feed-pump motor-starting and valve-solenoid circuits. The valve-solenoid circuit is from *A* through relay contact R_1, the solenoid coil, contact R, back to *B*. Energizing the solenoid opens the feed valve to boiler No. 2. The motor-starter circuit is from line *A* through relay contact R_1, the double-pole switch, motor-starter coil, and to *B*. This brings the feed pump into service.

When water level in the boiler is restored, level-control switch opens and stops the pump, unless the level-control switch has closed on No. 1 boiler. In that case, when relay contacts of No. 2 boiler open they break only the solenoid-valve circuit to stop water flow to that boiler.

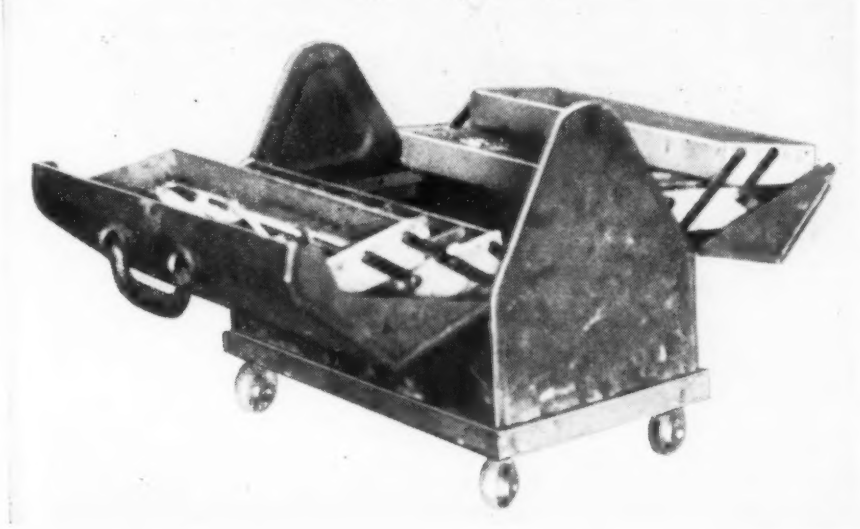
Motor contactor-coil circuit is maintained from *A* through right-hand contact of No. 1 relay to the double-pole switch coil *M*, and to line *B*. Consequently as long as No. 1 boiler calls for water, No. 2 pump stays in service. Closing the double pole switch to the left brings No. 1 feed pump under control of the boiler-water-level contacts; otherwise the control functions as explained.

Detroit, Mich. G L RADAMAKER

SCOOTER MOVES TOOL BOX EASILY

A HEAVY TOOL BOX can be moved about easily by mounting it on a caster scooter, as in the photo. The scooter, made by welding together four lengths of 1-in. angle iron, forms a frame into which the tool box fits snugly. On the underside of the frame at each corner attach a rubber-tired ball-bearing caster. Weld a small loop to one end of the frame, to which a rope may be attached for pulling the scooter around.

Chicago, Ill. CHAS A ARMSTRONG



Penstock Valve Fails During Inspection

BECAUSE A 66-IN. GATE VALVE leaked badly the erecting engineer prepared to inspect it to determine the cause of the fault. The valve was in the lower end of a penstock that served a hydraulic turbine operating under a 365-ft head. Just as the engineer started to enter the manhole with an extension light, power to the station failed. He got a candle and was about to enter the turbine casing again when the valve failed. After being badly washed about by the stream coming from the manhole he managed to escape alive, more by good luck than anything else.

When the headgate was closed to shut off the water and the turbine floor unwatered, the valve was found to have failed because of a faulty casting. A new valve worked satisfactorily for

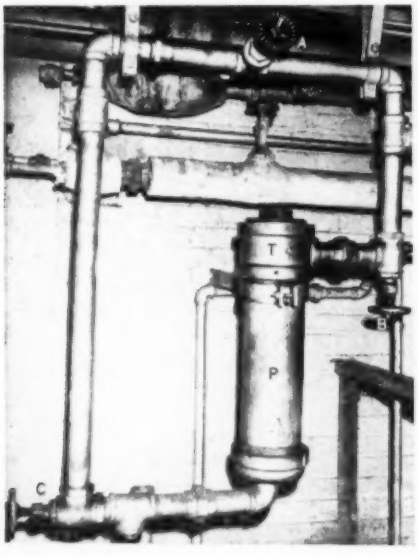
many years showing that the original design was correct.

Several serious accidents have occurred, some with fatal results, when valves or other parts failed under hydraulic pressure. This experience emphasizes the importance of taking every precaution when locating the cause of an indicated weakness in a part under water pressure. In the failure mentioned, the headgate should have been closed before attempting to inspect the gate valve. If this had been done, and the penstock permitted to leak until partly empty, the fault could have been just as readily determined without serious risk.

Cincinnati, O. H B McDermid

Cotton Filter Cleans The Compressed Air

Compressed air in our manufacturing processes must be free of odors and small particles of dirt. We eliminate



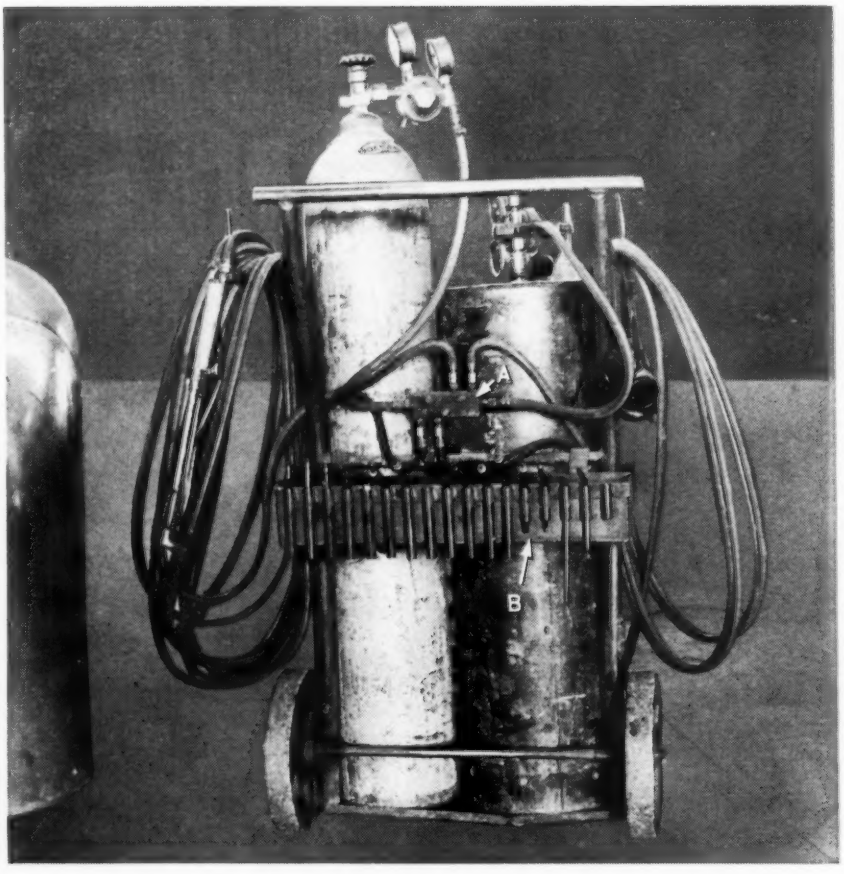
odors by using carbon-ring pistons in the compressors and by operating without cylinder lubrication. Even with filters on the compressor intakes, however, there were slight traces of fine dirt in the air, which got by the filters, and probably some dust from the carbon rings. We have eliminated these particles by an absorbent-cotton filter in the compressed-air line.

As shown in the photo the filter is made from a piece of 6-in. galvanized steel pipe *P*, 24-in. long. A cap on the pipe's bottom end holds a brass plate drilled with ⅛-in. holes for free air flow. Center of cap is drilled and tapped for the 2-in. outlet pipe. A 6- to 2-in. sprinkler-type T threads onto the top end of the pipe section. The 2-in. intake pipe threads into the T's side, and a plug closes its top.

The plug provides access to the filter body for filling with absorbent cotton. We have found that changing the cotton every two weeks gives us clean air. In fact, the cotton could probably be used much longer, particularly if the air were quite dry, but it does not cost much and changing it is an easy chore.

As shown, the filter is provided with a bypass. By opening valve *A* and closing valves *B* and *C*, the compressed air bypasses the filter for changing the filtering material. Opening valves *B* and *C* and closing *A* puts the filter back into service.

Brooklyn, N. Y. J P Carey



THIS WELDER HAS MULTIPLE TAKEOFF

One set of regulators and one of gas bottles may be dispensed with in the welding shop if a junction box is constructed so more than one welding or cutting tip can be used at the same time, as at *A* in the photo. The box, made of a substantial bar of steel, is drilled at one end to connect the hose from the acetylene cylinder, and at the opposite end for the oxygen connection. Each hole is tapped to receive the standard fittings accompanying conventional welding equipment.

On opposite sides of the steel bar, additional holes are drilled and tapped for individual oxygen and acetylene lines so two welding or cutting tools may be used simultaneously. Regulators on the cylinders are set to supply the required quantity and pressure of gases as if separate sets of cylinders were used. Board *B* has pockets containing the various-sized tips for different kinds of work: small tips for light sheet metal, and larger ones for other material.

Santa Monica, Calif. J C Albright

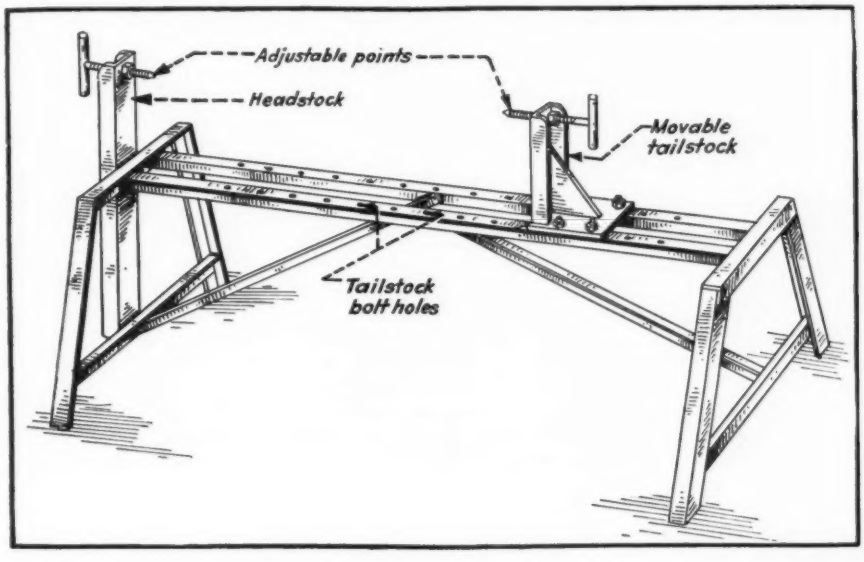
Chemical Mixup KO's Fire Extinguishers

While training a fire-fighting corps in a wood-working plant a demonstration fire was built in a safe place and allowed to get a good start. We were to demon-

strate the use of chemical fire extinguishers and the group got a good, if unexpected lesson. When the extinguishers were used in the normal manner nothing happened. It later developed that the two packages of chemicals used to charge the extinguishers were exactly alike, though marked differently. Of course the chemicals did not cause a reaction in the extinguisher so the fire continued to burn.

Subsequent investigation revealed that the packages were mis-marked in the shipment from which the chemicals were taken. After that we made it a practice to spot check every lot by mixing a small quantity of each chemical to make sure of its reaction. I have never heard of a similar failure in chemical fire extinguishers, but this experience indicates that such a mistake can occur. In a real fire that demanded quick action the situation might be serious if every fire extinguisher within reach proved to be a phony.

Cincinnati, O. H B McDermid



POSITIONER HOLDS PARTS IN EASY WELDING

Frame of the versatile welding jig in the diagram is made of different sizes of angle iron, and the head and tailstocks are of 3-in. channel iron, assembled by welding. The tailstock can be moved along the angle-iron ways and fixed with bolts in approximate position required by the piece to be welded. Final adjustment to the work piece is made by tightening the center points, made of ¾-in. bolts with short pieces of rod welded to one end to form a T-handle for ease of manipulation.

Nuts permit locking the bolts in position after they have been tightened on the work. A wheel or other circular part can be mounted on a short shaft held between the center points. Irregular shapes are held directly between the center points, and turned to any desired position that best suits the welder's convenience.

Birmingham, Ala. A J Beldon
The Linde Air Products Co.

A Little Gasoline Causes Serious Tank Explosion

Gasoline may cause disastrous explosions even when extensive precautions have been taken to eliminate this hazard. A gasoline tank was brought into the shop to have a fitting resoldered. The tank was first thoroughly dried, then filled with water, and allowed to remain for 48 hr. As it was then believed safe to be soldered, the water was drained out, and when the tank was dry repairs were started.

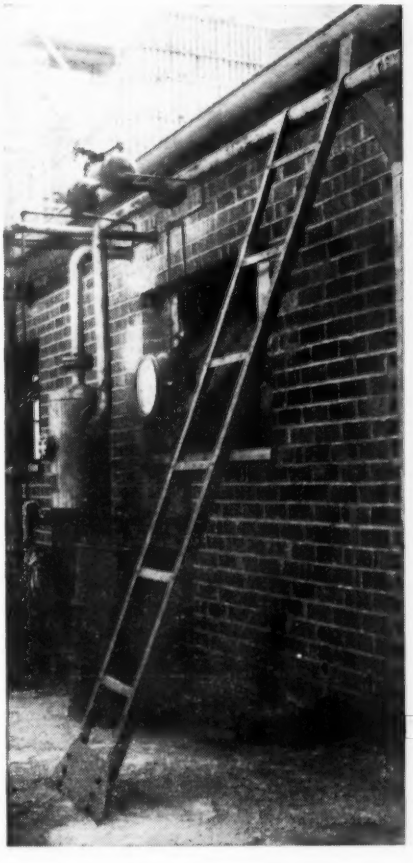
When the work was nicely under way, both ends of the tank blew out with a terrific explosion. Fortunately no one was in the line of flight of the tank ends or he probably would have been killed. The only injury was to the welder's hand, caused by a bar of solder leaving it in a hurry.

The precautions taken to purge the tank of gasoline would probably be considered ample to make it safe in most cases. This experience proves, however, that cold water cannot be depended on to remove all traces of gasoline. Such tanks should be purged for several hours with live steam, if it is available. In the absence of steam use boiling water and purge the tank several times. Safest practice is to throw away the old tank and get a new one. Such tanks may hold enough gasoline in their seams for several months to cause a destructive explosion when heated with a flame.

Richmond, Va. C R Anderson

Spade-Foot Makes Ladder Nonslip

A ladder frequently has a tendency to slip from under the man using it. This risk can be avoided by welding or bolting a flat sheet of steel to the lower ends of the side pieces, as in the photo.



Allow the plate to extend an inch or so below the ends so it bites into the floor or soil retaining the ladder in position regardless of the weight imposed. The ladder's top may also be provided with hooks to attach to pipes when used on them.

Chicago, Ill. Chas A Armstrong

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—Will Motor Operate Below Normal Speed?

OUR COOLING SYSTEM has a 6-blade propeller fan, 96 in. in diameter. It is powered with a 15-hp 240-v 1200-rpm dc compound-wound direct-connected motor. The field adjustment gives speed control from about 1100 to 2000 rpm, which is satisfactory for average conditions. On some days, however, the fan blows too much air. We have used a damper to control the air, but it isn't satisfactory.

I would like to operate the motor at slower speed, say, down to about 700 rpm. Our dc system is 120-240 v, 3-wire, so I thought we could operate on 120 v. When we tried it, the motor didn't work well, that is, it ran at about the same speed and had very little power.

Do POWER readers know how to connect the motor so we can get speed adjustment from 700 to 2000 rpm without wasting a lot of power in resistors? I would like to see a connection diagram we could use in rearranging our wiring—*RLG*

2—What Is Best Program Of Pump and Motor Repair?

OUR SYSTEM has a large number of motor-driven centrifugal pumps, ranging from 6 to 10 in. in size. These pumps circulate water through gravity and pressure filters.

At certain times, we have a chance to overhaul the equipment. In the past, when we disassembled a pump, the electrician would come in and work on the motor. If the motor had to be disassembled, we took the pump impeller and shaft out so the motor remained on its base. On several occasions, we have torn a pump down just to work on the motor. On some of these overhauls, new bearings were installed in the motors, and the units were reassembled without aligning the shafts. This makes excess wear in pump bearings, which causes vibration.

Because I am in charge of pump repair, I have opposed this procedure. It is impossible to shift the pump to line up with the motor. I argue that the motor should be moved when it is dismantled, or alignment is necesary.

I would like POWER readers to explain how jobs of this kind are handled in their plants so I can use their methods as arguments for changing our arrangements. If any one has a schedule or program of maintenance work, it would also be helpful. Do you agree that it is easier to shift the motor than the pump?—*DBD*

Answers to May Questions

What Is the Advantage of Each Boiler-Patch Shape?

(This is Question 1 from the May issue, with best answers from readers)

I have seen round, oval and diamond boiler patches and wonder why the different shapes are specified. On various occasions I have discussed this subject with other engineers but still haven't found the answer. I would like to know once and for all what the advantages are of each shape.

If POWER readers know why the different shapes are specified will they explain where to use each kind and show how to apply it. A sketch showing actual installation with rivets will be helpful because the patches I've seen are all different.—FWO

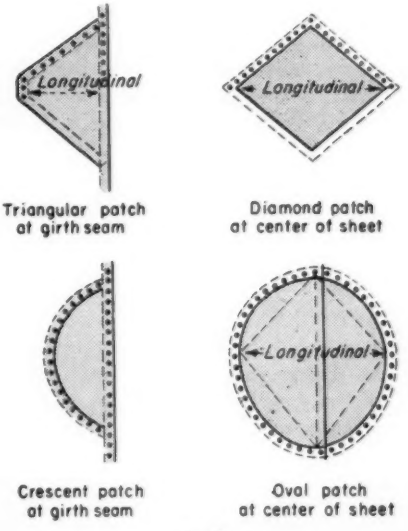
Be Sure Patches Are Correct Shape

SHAPE OF A BOILER PATCH depends on where it is used. It is generally accepted that, if the length of a patch—longitudinal dimension of boiler—is 24 in. or less, its width must be twice that figure. If the length exceeds 24 in., the width is determined by certain rules, and it usually comes out slightly less than twice the length. If a patch longer than 60 in. is required, the width should be not less than five-eighths of the boiler circumference. The longitudinal and girth seams of the patch should duplicate the original boiler seams.

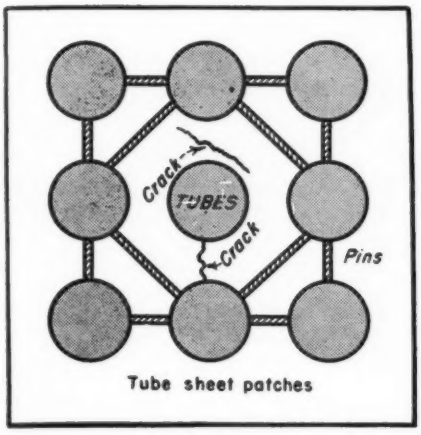
From this we see that a circular patch is eliminated. If FWO has seen such patches, they are poorly designed. Triangular and crescent patches are used at head seams and girth seams, diamond and oval patches in the center of the sheet, sketch 1-A. There is a slight saving in material when patches are triangular or diamond. These may be shortened in width, provided no more than four rivets are parallel to the longitudinal seams.

The patch plate should be equal in thickness to the original plate. It should bear the steelmaker's stamp, which consists of the manufacturer's name, classification of plate as firebox or flange, and tensile strength. Distorted part of the shell should be set back to its original contour, requiring the patch to be as small as possible. Determine the shape, after calculating length and width, then cut out affected part with an acetylene torch.

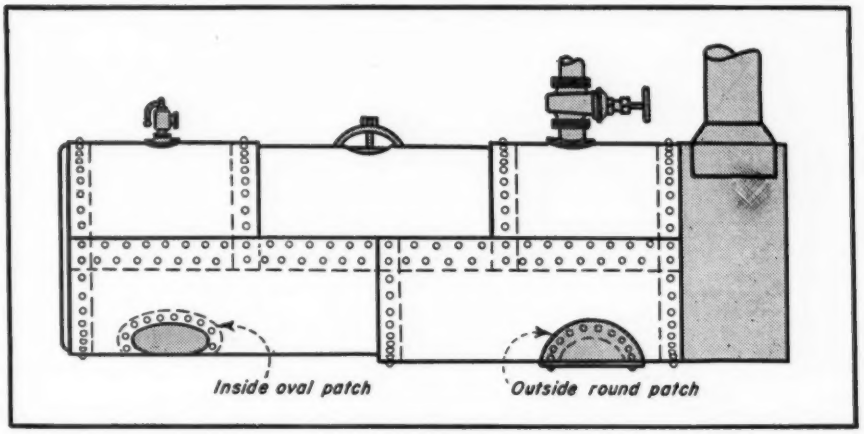
When patch is exposed to combustion gas, use single-riveted lap joint. When



1-A



1-B



1-C

not in contact with combustion gas, use double lap joint or stronger. An exposed patch can use firebox-quality steel, but flange quality is allowed when not exposed. Place patches inside the shell. Patches that include bottom blow-off outsets can be on the outside.

Remember that such repairs should not be attempted without the approval of a qualified boiler inspector.

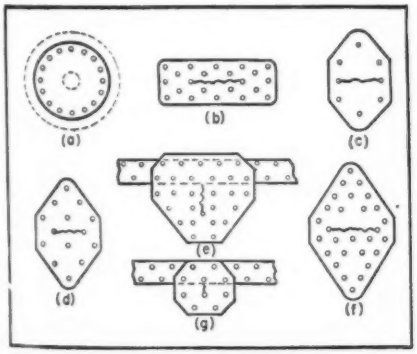
Philadelphia, Pa. J S HAMILTON

Location of Patch Determines Shape

MAIN FACTOR in the design of boiler patches is location of cracks and condition of plates. If crack is in the tube sheet., *FWO* should use a square or diamond patch, as in sketch *1-B*. If crack or weak spot is in the boiler plate, and patch is to be on the inside, you can get an oval patch through the hole as shown in sketch 1-C. If patch is to go on the outside, the common round patch is best.

Oval and round patches make a better calking job and a tighter joint than diamond and square ones. When possible use a round patch as it makes a much stronger job.

Sault St. Marie, Ont. A J SMITH



1-D

Use Different Shape For Each Crack

SIZE OF HOLE AND CRACK influences patch shape. Different shapes are used to keep patches from making the shell weak. If all holes and cracks were repaired with the same kind of patch, unnecessary rivets would be used. Sketch 1-D shows various patches, which are employed as follows:

At *a* circular patches are used over holes two in. in diameter and under. Holes between two and four in. require circular patches, reinforced both inside and outside. Patch at *b* is for circumferential cracks; *c* is for crack in shell two in. and under, while *d* is for cracks in shell from two to four in. long. Circumferential seam cracks from four to eight in. long take patch as at *c*. For cracks in shell eight to twelve in. long use *f*. Use *g* for seam crack in shell two in. and under. All patches must be same thickness as the shell.

Oaklyn, N. J. S W WILKES

Oval and Diamond Patches Give Greatest Strength

OVAL OR DIAMOND PATCHES are generally specified because the greater part of the single-riveted lap joint of patch runs more nearly circumferentially as in sketch 1-E. This gives a joint strength about equal to that of the girth seams.

Either of these patches can be used to repair the shell bottoms of hrt boilers that are damaged.

The damaged section of shell bottom —usually over the furnace—is cut out in oval or diamond form with rounded corners as in sketch.

Cut the patch from material having tensile strength equal to that of the original shell plate. Its shape should be the same as the cutaway section of shell plate, but large enough to allow for overlap when riveting. Thoroughly clean or trim the patch and shell joint surfaces, if necessary, and apply a coat of red lead or iron-rust cement.

Montreal, Que. ARTHUR BELTON

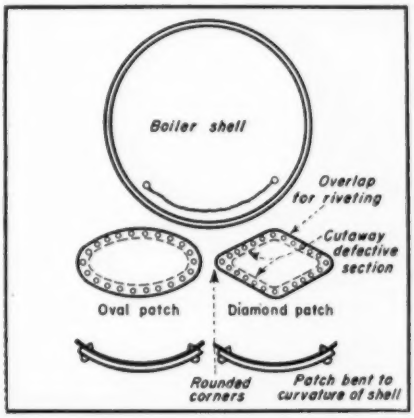
Patches Can Be Soft or Hard

THERE ARE TWO KINDS of patches: (1) A hard patch, which is riveted, covers a damaged section. (2) A soft patch, which is fastened with bolts, covers a leak or other defect.

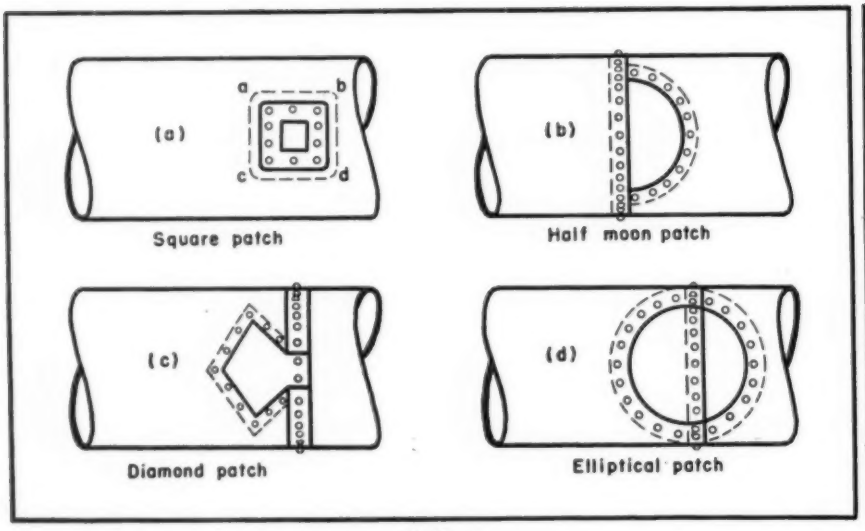
A hard patch is used as a permanent repair. The damaged metal is cut out before it is applied. Don't rivet the patch to fireside of plate because rivets are in tension, and pressure tends to force the patch over rivets' heads. In addition, a pocket forms and accumulates scale and sediment, causing the plate to overheat and burn.

Shape of a hard patch depends on nature and location of repair, and how the patch can best be secured to the boiler. Avoid the square patch, sketch 1-*F* at *a*, as it is the weakest shape.

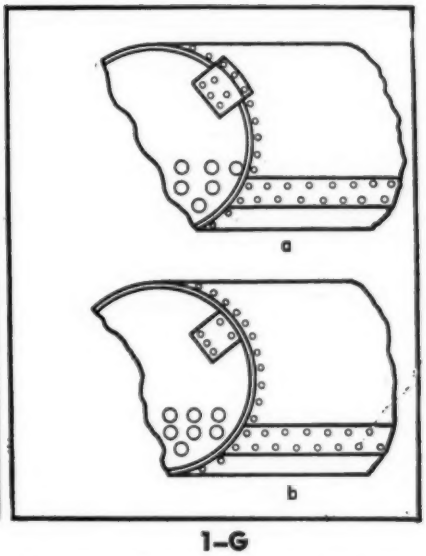
To keep joint strength as high as pos-



1-E



1-F



1-G

sible in a boiler patch, use the diagonal joint. For a given internal pressure, stress in boiler shell is twice as great per inch of longitudinal seam as per inch of girth seam. Consequently, the girth seam need not have joint efficiency greater than half the longitudinal seam. For this reason, girth seams are usually single-riveted. Since the ratio of the stresses in longitudinal and girth seams is 2 to 1, stress varies as the angle of the seam when it is placed diagonally.

Patches at *b*, *c* and *d* have virtually diagonal joints with effective efficiency greater than longitudinal joints of like proportions. Patch at *b* is used over bulges and damaged plate sections near the girth seam. Diamond patch at *c* has two advantages: Less material is removed and, where such patch runs into the girth seam, less lap of this seam is removed. An elliptical patch is shown at *d*.

A soft patch is never used near fire or intense heat, or in contact with water.

Before bolting a patch in place, washers should be placed under the nuts and cotton lamp wicking impregnated with putty wound around the bolts underneath the washer. When bolts are tightened, putty is squeezed into the opening around the bolts and patch plate, producing a steam-tight joint.

Cracks often occur in the curved part of the flange on boiler heads. When they are too extensive to repair by sewing, a soft patch may be applied as in 1-*G*.

The offset in the patch plate at *a* makes it difficult to install, so the patch at *b* is generally used. It is bent to fit the flange curvature, and the extreme ends are bent to fit the boiler-head curvature. The shell plate is wedged away from the flange so the lap of patch can be slipped between shell and boiler head.

Oaklyn, N. J. C A WILKES

Back Issues of POWER Answer the Question

I WOULD LIKE to refer *FWO* to an article in POWER entitled, "Boiler Patches: Bolted, Riveted or Welded?" by Harry M Spring. It is in two parts, July 1946, p 103, and August 1946, p 103. It gives a fine explanation of the shapes of boiler patches as well as their engineering design.

Des Moines, Iowa S R HIGGINS

Write for Booklet On Boiler Repairs

THE SHORTEST ANSWER I can give to *FWO's* question is to suggest he write for the booklet, distributed by the boiler inspection department in most states, governing repairs of power boilers. A good one may be obtained, without charge, from the Bureau of Labor Statistics, State of Texas Boiler Inspection Division, Austin, Texas.

This booklet, covering patch design and application, should answer all his questions. Its title is "Boiler Law Rules & Regulations—State of Texas".

New Orleans, La. W R KILBOURN

Will Generator and Motor Start Together?

(This is Question 2 from the May issue, with best answers from readers)

Our power plant has a 750-kw 440-v 200-rpm engine-driven generator and a 1000-kva 2300-v 3600-rpm turbine-generator set, both connected to the same system through transformers. I want to run the 1000-kva generator independently of its turbine as a synchronous motor to check vibration. We tried starting it as an induction motor from the smaller engine generator, but it was no-go. The smaller generator just died every time we closed the circuit.

Someone suggested connecting the two machines electrically and starting them simultaneously. I would like to know whether this can be done, and if so how you go about it. Every time we tried it the engine generator started with a jerk and the circuit breaker jumped out.—ALD

Connect Both Generators And Start as a Unit

STARTING THIS 1000-kva generator as a synchronous motor should not present any serious problem. I assume, of course, that the 750-kw machine is used exclusively for starting the 1000-kva machine.

Both machines are tied together electrically as in sketch 2-*A*. The fields of both machines are excited to about one-half normal. The 750-kw unit is then started slowly. As it begins to turn, the 1000-kva machine should come up to speed with it since they are locked in synchronism. This is an old method for starting machines that don't have starting windings.

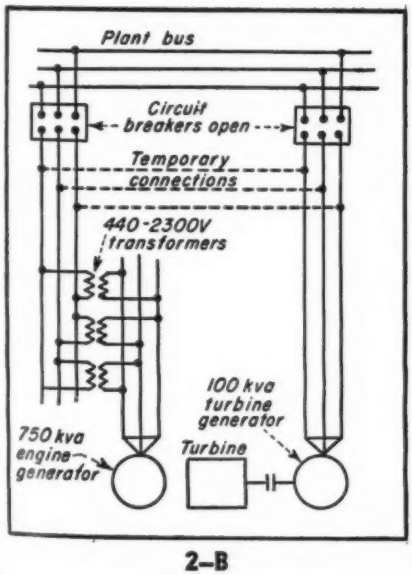
The explanation is quite simple. Opposition to flow of ac in any machine, such as the 1000-kva generator, consists of resistance or IR drop in the windings and reactance which is directly proportional to the frequency. Since the frequency is very low at

starting, the limiting factor to current flow is resistance and low voltage produced. As the speed increases, the frequency increases and the current remains fairly constant.

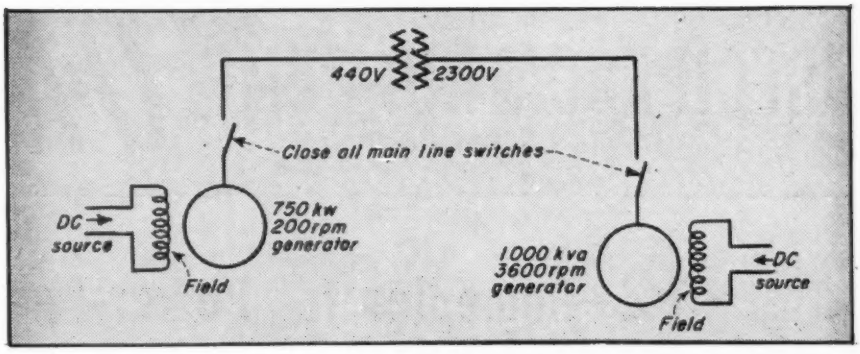
The 1000-kva generator's rotor has steel, slot wedges, which act like a squirrel cage when starting as an induction motor as *ALD* mentioned. He failed to start the 1000-kva machine from the already running 750-kw generator probably because of the relative size of the two machines and the poor starting characteristics of the larger one. In the scheme suggested (which is used fairly regularly) the machines are tied together synchronously, since the fields are excited at standstill.

ALD mentions that when the machines were tied together electrically, trouble was encountered. It might be that field excitation on the 750-kw generator was too high. This causes too fast a buildup of voltage, which tends to accelerate the 1000-kva machine too quickly with a corresponding inrush of high current. Correct excitation for both machines should be about 50% of normal. Excitation may have to be independently varied on both machines until a value is found that starts them together. Excitation for the emergency starting has to have a dc source, independent of either machine, such as a battery or an independent mg set. If either machine has a direct-connected exciter, it cannot be used for this emergency starting. The transformer between the two machines has no bearing since its inductance and voltage ratio varies with the speed of the 750-kw machine.

Kansas City, Mo. E J KELLEY



2–B



2–A

Isolate Generators And Start Together

ALD does not state whether his generators are excited by mg sets or by mounted exciters. If machines are separately excited, he should merely disconnect his generator buses from the utility, close both generator circuit breakers and field switches. Exciters should be set to have a strong field on both machines. The 1000-kva unit will then begin to revolve as soon as the 750-kw set is started. If it is not possible to isolate the utility bus, *ALD* will have to make a temporary connection as in sketch 2-*B*, and operate with generator circuit breakers open.

In either case, the units have to be excited from an outside source since turboalternators have no amortisseur windings, and hence cannot be started as motors without a strongly excited field.

Princeton, B. C. A R EASTCOTT

Here's How I Start A 4-Pole Generator

STARTING a 2-pole turbine-generator and pulling it into step may present some difficulty. My experience with a 4-pole machine, however, was perfectly satisfactory; it started as described below.

Tie the engine generator and turbine-generator together electrically. Open the field switches on both machines. Connect a resistance of about three times the field winding resistance across the collector rings to prevent excessive induced voltage in the 1000-kva generator field. Start the engine and, when running at full speed, close its field switch. Raise the voltage gradually as the larger machine comes up to speed. Slowly open the resistance across the field of the turbine-generator when it is running at about half speed. This prevents it from locking in at sub-synchronous speed. If you apply excitation when speed is about 95% normal, it should pull in.

Hamilton, Ont. J A COULDEN

Tie Machines Together And Give One a Push

THE 1000-kva TURBINE-GENERATOR will not start as an induction motor, because it does not have amortisseur (squirrel-cage) windings.

I have used the following procedure to motorize one turbine-generator from another. It should also be applicable to motorize *ALD's* turbine-generator from the engine set. This method depends on having controllable dc power available for separate excitation of the two machines. (1) With both units at rest, close the circuit breakers and disconnects between them. (2) Excite the field of the turbine-generator with field current normally used to generate 2300 v at no load. If value of field current is not known, determine it by a preliminary run. (3) Excite the field of the engine-generator with about one-third the field current necessary to generate 440 v at full speed, no load. (4) Start the auxiliary lubricating-oil pump to supply pressure to the bearings. Roll the turbine set by hand or other means in the direction it normally runs. (5) As soon as the man who starts turbine set turning is in the clear, start the engine as slowly as possible. The two machines should pull into synchronism and start up together.

If the breaker between the two machines does not have an inverse-time delay feature, it might be necessary to set its tripping relay to the limit to prevent tripping when the two machines are trying to pull into step. When the machines are up to full speed, the fields should be adjusted to give normal voltage and minimum circulating currents as measured by power-factor meter or ammeters.

(*Continued on page* 146)

RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

12—Remedies for Power-Pump Troubles

In the twelfth of a series, E F Wright, chief engineer, reciprocating pump division, Worthington, selects questions and answers that give practical understanding of construction, operation, characteristics, troubles and remedies.

Q 1—Why do power pumps fail to discharge?

A—They fail from the same causes as direct-acting steam pumps. See causes and remedies for "Pump fails to discharge," in the check chart for causes and remedies of trouble on p 120, July 1947 POWER.

Q 2—Why do power pumps fail to discharge full capacity?

A—From the same causes as direct-acting steam pumps. See causes and remedies for, "Pump not up to capacity," in July chart.

Q 3—What causes the suction or discharge line, or both, to vibrate on a power pump?

A—Vibration is generally caused by either the suction or the discharge line, or both, being too small. See remedies in chart on page 118, of this issue.

Q 4—What causes liquid end of a power pump to pound or vibrate?

A—Among the causes are: (1) air or gas in the liquid; (2) suction lift too high or insufficient suction head; (3) pump speed too high for existing hydraulic conditions; (4) pounding of discharge or suction valves, or both; (5) pump cylinders' failure to fill completely; (6) viscosity of liquid too high. See remedies in chart on page 118, of this issue.

Q 5—What causes power end of pump to pound or vibrate?

A—Causes are (1) excessive speed (2) loose or worn bearings (3) loose or worn crosshead or guides (4) loose crosshead pin or crank pin (5) gears out of line or improperly adjusted (6) worn or noisy gears. See remedies in chart on page 118.

Q 6—What causes a power pump to take excessive power?

A—The packing may be too tight, the discharge pressure too high, or the liquid's viscosity so high as to cause excessive friction losses in suction and discharge lines. See remedies in chart on page 118.

Q 7—How can the liquid end of a power pump be checked for leakage of valves or between chambers?

A—A slip test, such as is used on a direct-acting steam pump, cannot be applied to a power pump unless it can be turned by hand against a closed, or practically closed, discharge valve. Unusual fluctuation of suction or discharge pressure is a good indication of internal

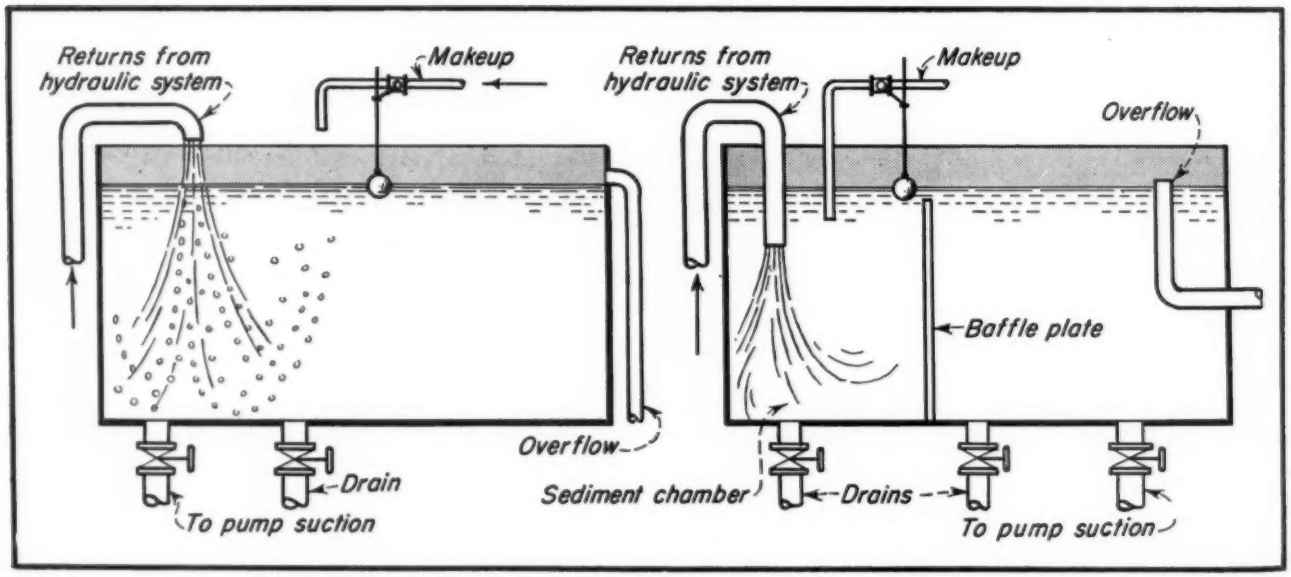
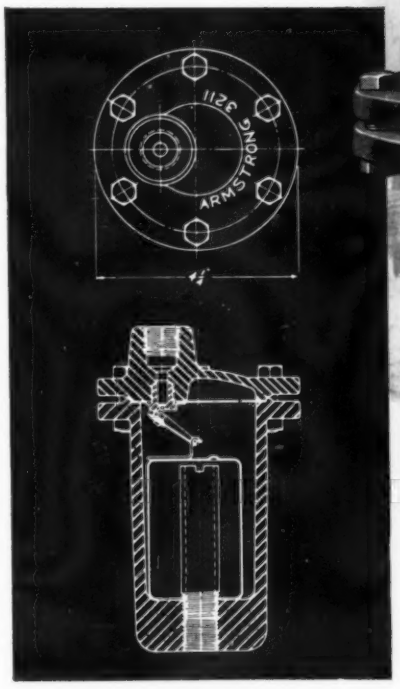


Fig. 1—Wrong way to bring returns and makeup into tank. Air in return, plus that carried below water surface by jet, enters suction as small bubbles, causing rapid pump corrosion when bubbles collapse at the start of discharge

Fig. 2—Right way to bring returns and makeup into tank. End of return and makeup lines submerged behind baffle. All water flows slowly over baffles to release air. Baffle far enough below low-water level not to disturb flow

GOOD NEWS for Engineers

in POWER AND PROCESS PLANTS



— A new, low cost ALL-STEEL steam trap

THE NEW Armstrong No. 3211 *forged steel* trap is designed and built to meet the needs of engineers in power plants... steel mills...process plants for a small size, moderately priced, high quality steam trap. *It's tough* — the forged steel body will withstand hard knocks that would shatter ordinary cast iron traps. *It's safe!* — no danger of the body weakening under high pressure when exposed to fire. Inside, it has the same *all-stainless steel* operating mechanism that's used in Armstrong traps built for pressures up to 1500 p.s.i!

This new trap is now in production in the Armstrong factory. If you are in need of traps of this type, see your local Armstrong representative at once. If it is an urgent matter, write, phone, or wire ARMSTRONG MACHINE WORKS, 812 Maple St., Three Rivers, Michigan.

QUICK FACTS

- SMALL SIZE—Height, 7"; diameter, 4¼". ½" pipe connections.
- BIG CAPACITY—Up to 900 lbs. per hour continuous discharge capacity, depending on pressure.
- PRESSURE—Suitable for operating pressures up to 250 p.s.i. Body is actually built to withstand much higher pressures.
- ORDERING—List price, $14.00. Specify operating pressure.

ARMSTRONG *Inverted Bucket* STEAM TRAPS

Over a Million in Use...For Power...Process...Heating

leakage, as is the speed or operating time the pump requires to deliver a known volume of liquid. A final check can be made only by applying water pressure to the suction or discharge chambers and looking for leakage past the valves or into adjacent chambers.

Q 8—Why is it important to drain and replenish the oil supply regularly in any inclosed crankcase power pump?

A—The oil becomes contaminated, particularly by condensation, and must be renewed as often as existing conditions require. Whenever a pump is shut down, especially in a humid atmosphere, condensation occurs as the pump cools. After settling, most of this water and some of the dirt and grit, which accumlate in any oil sump, may be drawn off from its bottom. At regular intervals, however, draw out all oil and thoroughly clean the sump. If a centrifuge is available, oil which is not too badly contaminated can be cleaned for further use. When there is doubt about the oil's condition, it is better to replace it than run the risk of damaging costly machinery.

Q 9—Why is it important to keep connecting-rod bolts pulled up tight at all times?

A—A machine part, subjected to widely fluctuating loads, fails much more quickly than a similar part carrying a constant load of the same or even greater magnitude. A failure caused by repeated application and removal of load is known as fatigue failure. Bolts or studs joining two parts that are alternately loaded and unloaded should be given a greater initial stress than that occurring under operating conditions. This has the effect of putting a steady load on the bolts and prevents fatigue failure, although the parts joined are not under a constant load. Connecting-rod bolts, subjected to additional stress due to shock when bearings wear loose, need attention to keep them tight.

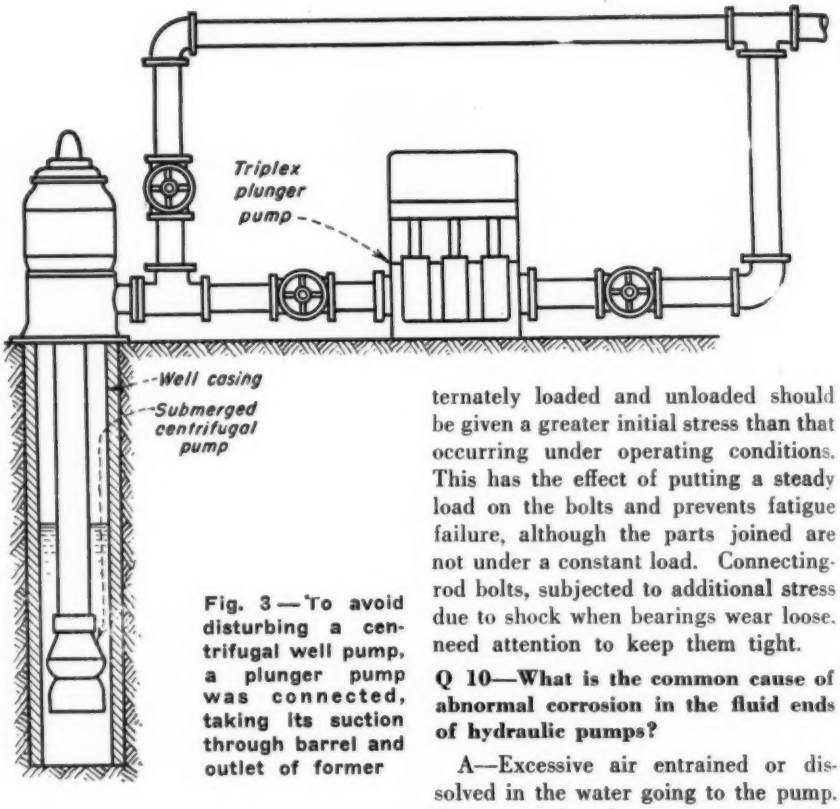


Fig. 3—To avoid disturbing a centrifugal well pump, a plunger pump was connected, taking its suction through barrel and outlet of former

Q 10—What is the common cause of abnormal corrosion in the fluid ends of hydraulic pumps?

A—Excessive air entrained or dissolved in the water going to the pump. Returns and makeup to pump-suction supply tanks are too frequently arranged so that air bubbles are carried down into the water and into the suction outlet, Fig. 1. This air collects on the suction stroke as small bubbles above the suction valves and in the plunger chamber. The violent collapse of these bubbles, as pressure increases at the start of each discharge stroke, creates a shock condition not unlike cavitation.

This action destroys the iron-oxide coating on the cylinder and other surfaces that the bubbles contact, to expose fresh metal to the corrosive attack of air and water. Submerge all return and makeup lines in a section of the supply tank separated from the suction end by a submerged baffle, Fig. 2. By making all the water flow over this baffle, submerged a few inches below minimum water level, a large part of the dissolved air can escape before the water enters the suction line.

Q 11—A motor-driven triplex shallow-well pump in an installation requiring a relatively high suction lift was difficult to prime when first started. Soon it lost its prime on one and sometimes two plungers even though pumping continued at proportionately reduced capacity. What caused this action?

A—Well draw-down caused by over pumping was partly responsible, but an unusual suction line with an excessive

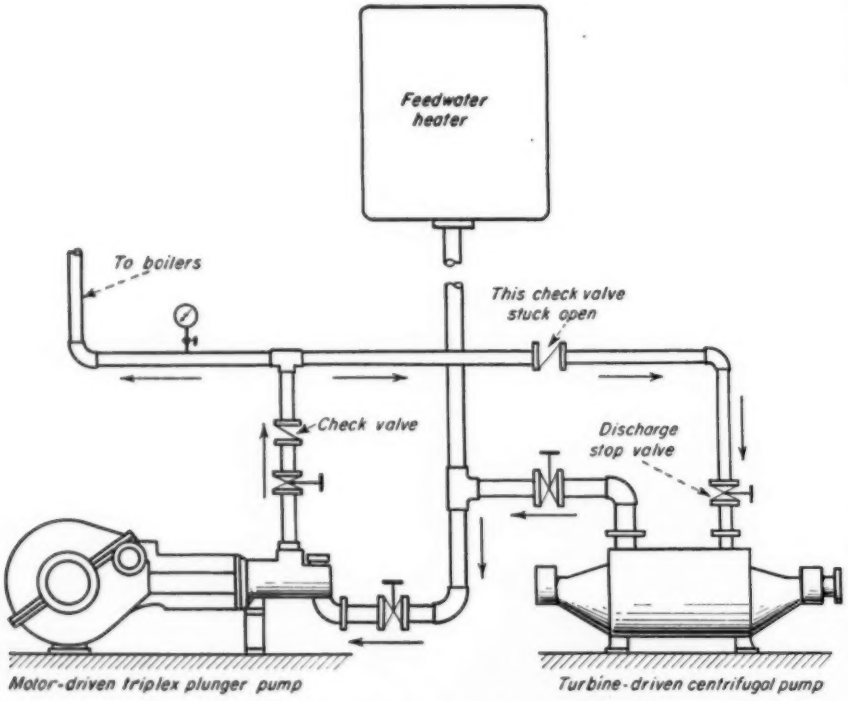


Fig. 4—Motor-driven triplex boiler-feed pump, in parallel with a turbine-driven centrifugal pump, refused to discharge into the boilers because, as it was found later, the check valve of the centrifugal pump was stuck wide open

Tops FOR TOP PRESSURES

On steam lines where pressures go as high as 1500 psi, and temperatures up to 900° F. are encountered, steam traps must be rugged . . . and *efficient!*

That's why so many public utilities and other high pressure steam plants are installing Yarway Integral Strainer Impulse Steam Traps. First cousin to the famous standard Yarway Impulse Steam Trap, the integral strainer trap has been developed especially to meet high pressure trapping requirements.

It has ample condensate capacity when system is being "warmed up." Yet it will handle relatively small amounts of condensate efficiently without losing prime. The valve closes positively in the presence of dry or superheated steam.

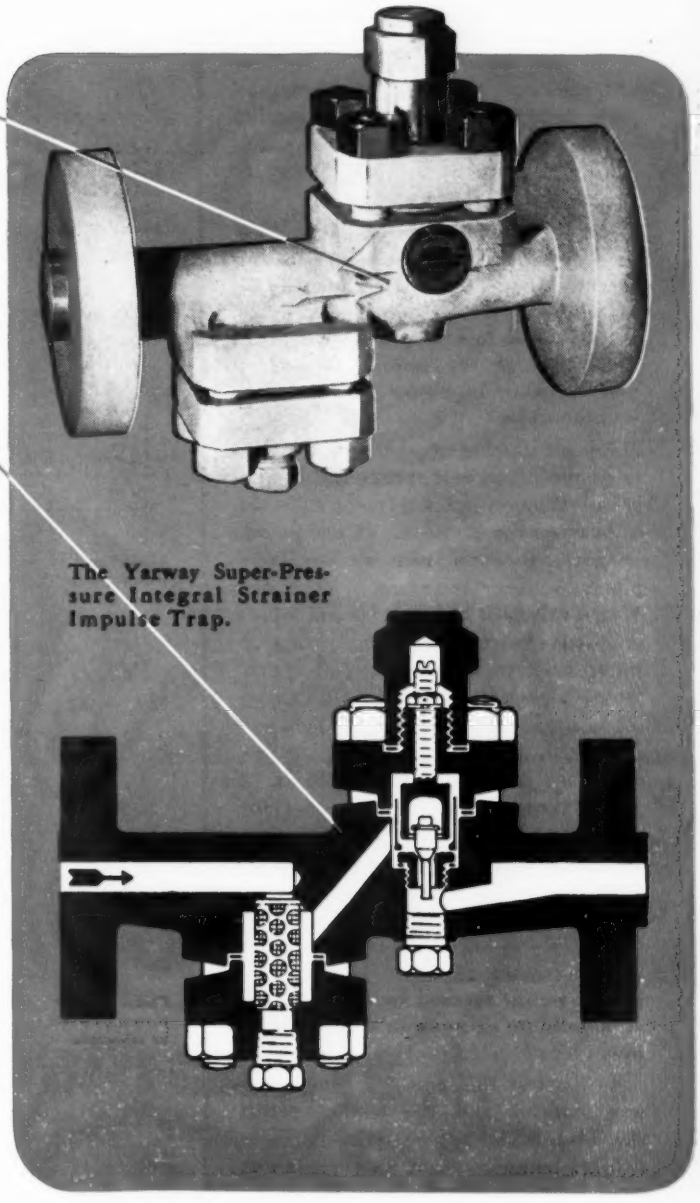
It is a fraction of the size and weight of other type traps designed for the same service—saving space, simplifying installation and requiring no supports.

It is suitable for all pressures within a wide range without change of valve or seat.

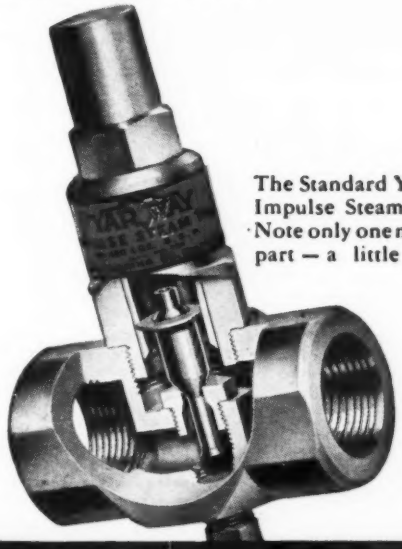
It has the same simplicity of design as does the standard Impulse Trap shown below—only one moving part, the same little valve.

Its integral strainer protects trap against scale and rust in the piping system.

Available with flanged or socket weld connections. Write for Bulletin T-1739.



The Yarway Super-Pressure Integral Strainer Impulse Trap.



The Standard Yarway Impulse Steam Trap. Note only one moving part — a little valve.

See these traps and other Yarway steam plant equipment . . . hear their operation described by Lowell Thomas in the Yarway color motion picture, "There Is An Engineering Reason." Available without charge for group showings. Write today.

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YARWAY IMPULSE STEAM TRAP

friction loss was the primary cause. Suction was taken through the barrel of a centrifugal well pump which filled the well casing, Fig. 3. Reducing the pump's speed decreased discharge rate, which in turn reduced the friction loss and well draw-down to where the pump could work at a lift of 22 to 25 ft of water instead of failing at more than 26-ft lift. Later an ordinary suction line of proper size was installed, which permitted the pump to work at a somewhat increased capacity.

Q 12—A motor-driven triplex boiler-feed pump operated satisfactorily at minimum speed but overloaded its motor badly at increased speed. This overload reached a peak once each revolution of the pump, causing a violent swing in power input. What was the cause?

A—Satisfactory operation at 50% rated speed makes it seem unlikely that an obstruction in the pump's liquid end caused the overload. It was found, however, that on two of the three plungers the valve stops limited discharge-valve lift to about $\frac{1}{8}$ in., which imposed a severe throttling action as water velocity increased. Apparently these valves initially had just enough lift to the stops to permit full-speed operation, but compressing the gaskets under the valve plugs caused the difficulty. Cutting back the stops to allow valve lift of $\frac{1}{4}$ in. cured the trouble.

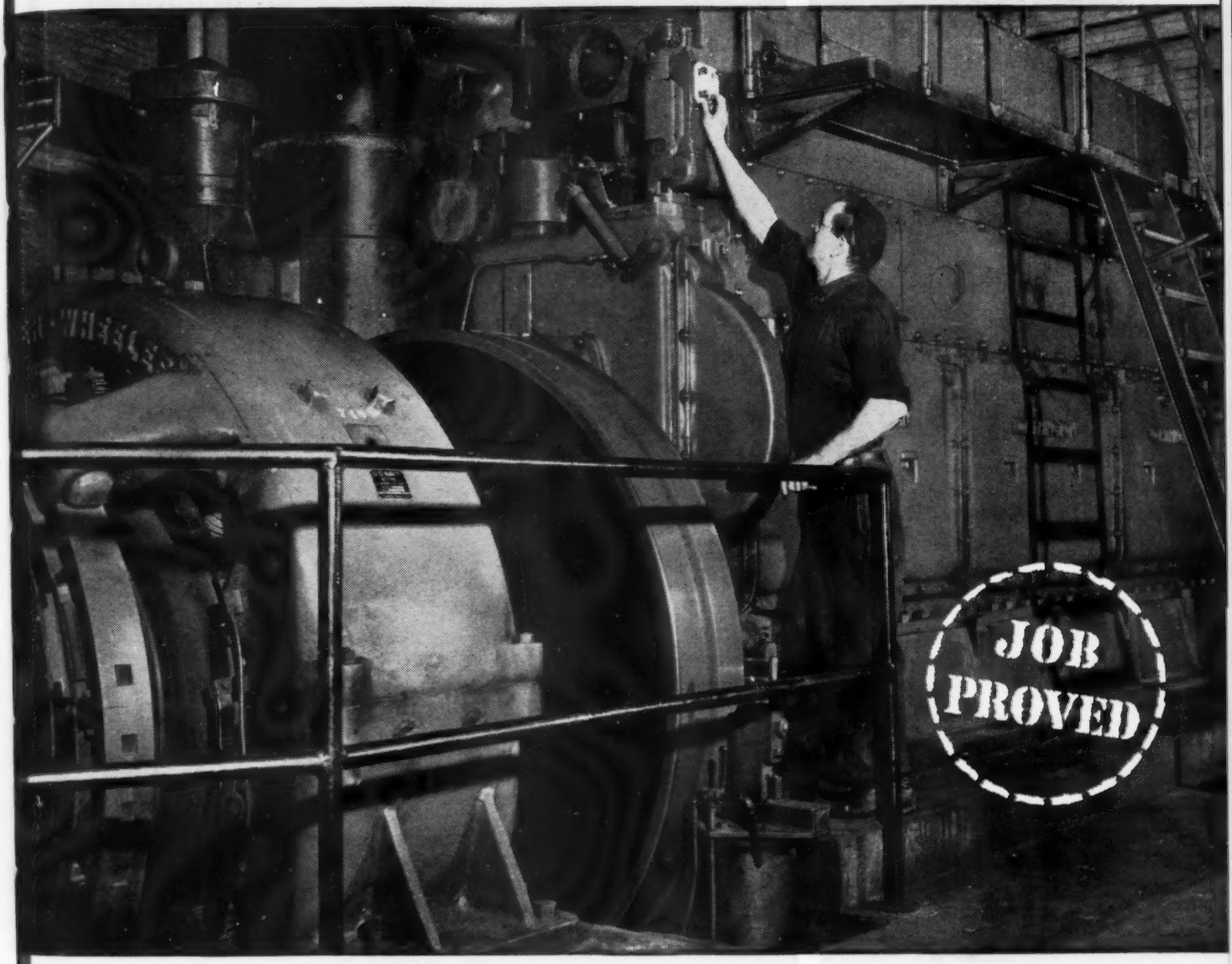
Q 13—A motor-driven triplex boiler-feed pump was installed in parallel with a turbine-driven centrifugal unit, Fig. 4. Following replacement of suction and discharge valve springs, the triplex pump refused to discharge or even build up pressure in the discharge line. Why?

A—To test this unit the centrifugal was stopped and the triplex pump started. Between each trial the centrifugal pump was run long enough to keep water in the boiler. Since the triplex pump had worked before putting in the new springs, it was assumed that the pump was air bound and for some reason it would not expel air and prime itself even though there was a reasonable suction head. Finally, instead of depending on the discharge check valve to prevent backflow through the centrifugal pump, its discharge stop valve was closed. Pressure and feed to the boiler were immediately established, showing that the check valve in the centrifugal discharge was stuck open during the triplex-pump trials.

CHECK CHART FOR CAUSES AND REMEDIES OF TROUBLES IN POWER PUMPS

SYMPTOM	CAUSE	REMEDY FOR TROUBLE
Pump fails to discharge.	1 *Same as for direct-acting pumps.*	Same as for direct-acting pumps; see chart on page 120, July 1947, Power.
Pump not up to capacity.	1 *Same as for direct-acting pumps.*	Same as for direct-acting pumps; see chart on page 120, July 1947, Power.
Suction and/or discharge line vibrates or pounds.	1 *Suction line is too small.*	Increase size of line, decrease its length. Use a centrifugal booster pump to keep minimum of fluctuating pressure above the flashing point of the liquid pumped. Use a suction-air chamber at pump suction to smooth out the flow in the suction line.
	2 *Discharge line is too small.*	Increase size of line, shorten it if possible. Use a discharge air chamber, if practicable, to smooth out flow in line. If two or more pumps discharge to a common manifold some distance away, install equalizing lines between pump discharge connections.
Liquid end of pump pounds or vibrates.	1 *Air or gas in liquid.*	If air or gas is released by suction lift, install separation chamber near pump with automatic air-removal apparatus. Check for and correct air leaks in suction line and around stems of valves. Low-liquid level in suction well or turbulence, due to inflow falling into well close to suction pipe, may cause entrainment of air. Submerge inflow lines at a maximum distance from suction pipe.
	2 *Suction lift is too high or suction head is insufficient.*	Older low-speed pumps may be capable of operating at a suction lift of 22 ft on cold water, but higher-speed pumps may require a flooded suction or even a positive-suction head. Consult manufacturer for suction requirements, and provide ample suction head at all times.
	3 *Excessive speed.*	Operate at rated speed for average conditions. If lines on suction and discharge are long, reduced speed may be necessary. If suction head is ample, increase strength of valve springs in proportion to square of increase in speed.
	4 *Valves are pounding.*	Look for broken or weak valve springs. Replace as required. Increase strength of springs if suction head permits or reduce pump speed.
	5 *Pump does not fill.*	Increase suction head or reduce speed of pump. Reduce strength of suction valve springs in proportion to square of speed reduction.
	6 *Viscosity too high.*	Heat liquid to reduce viscosity or reduce pump speed and possibly valve-spring loading.
	7 *The pump vibrates.*	Check for alignment. Be sure pump is level and properly supported.
Power end of pump pounds or vibrates.	1 *Speed is excessive.*	Reduce speed to rated value or to meet operating conditions.
	2 *Loose or worn bearings.*	Tighten or replace bearings. Bearing bolts, particularly at crankpin end of connecting rod, must be kept tight at all times.
	3 *Loose or worn crosshead or guides.*	If crosshead has separate shoe, adjust or shim-out shoe to restore original running clearance. Rebore guides as required and install oversized crossheads to suit.
	4 *Loose crosshead pin or crankpin.*	Replace with properly fitted pins and adjust bearings to suit new pins.
	5 *Gears out of line or improperly adjusted.*	Realign gears for even tooth bearing and adjust to proper backlash.
	6 *Worn and noisy gears.*	Replace gears, adjusting as in 5, above.
The pump takes too much power.	1 *Packing is too tight.*	Check packing; if too tight make necessary adjustments or replace with correct type of packing, properly installed. Do not fill stuffing boxes too full; allow for expansion.
	2 *Discharge pressure is too high.*	Check piping system for abnormal obstructions such as a partly closed valve. If installation is new or changed, recalculate friction loss through fittings and pipe. Check discharge head against rating of pump. Reduce size of piston or plunger to get no more than manufacturer's rated pressure for size of piston or plunger used. Power pumps are built for a certain maximum cylinder pressure with a minimum-size piston or plunger. Use of larger-size pistons or plungers requires a proportionate reduction in discharge pressure to avoid overloading the power end of the pump. If motor is overloaded, reduce speed of pump if pressure is within the pump's rating; otherwise, reduce load on motor and pump by changing to smaller pistons or plungers. At rated speed, install larger motor if this will not overload the pump.
	3 *Viscosity of liquid causes excessive friction loss.*	Increase pipe size, reduce pump speed, or reduce viscosity of liquid by heating.

Rings Free . . . After 9,200 Hours



SUNVIS DIESEL LUBRICANTS . . .

Keep This Engine Operating Smoothly, All Piston Rings Free and Bearings O.K.

This 750-h.p., 6-cylinder, Worthington diesel, direct-connected to an electric generator, has been completely protected by Sunvis Oils since the day it was installed.

Recently it was torn down for inspection after 9,200 hours of operation. All piston rings were free, and oil-ring slots were open. Main and connecting-rod bearings were in first-class condition, and not one had to be replaced. There were no hard, gummy carbon deposits.

The perfect condition of this engine is typical of the condition of machines protected by Sunvis Oils. Sunvis Oils are high-viscosity-index lubricants, many of which are specially fortified to resist oxidation. Their ability to stand up on tough jobs is helping many manufacturers to keep plants running smoothly and to produce more for less.

The new Sunvis Oils were developed to stand up under high speeds, heavy loads, and continuous operation even under variable temperature conditions. Their long life and stability have been "Job Proved" in steam turbines, air compressors, diesels, and other kinds of machines. For full information call your nearest Sun office, or write Department P-8.

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MATH TIPS

PHIL SWAIN GIVES HELPFUL HINTS TO EVERYDAY USERS OF NUMBERS AND HOMESPUN MATHEMATICS

FREEHAND FIGURING—2

▶ LAST MONTH I TRIED to show that approximate mental arithmetic—freehand figuring—is really a high-class art, one in which most top-flight engineers and scientists are expert. The idea is to get a rough answer quickly for preliminary estimates and similar uses without benefit of slide rule, reference books, or even pencil and paper.

The errors involved in cutting a lot of corners may range from 1 or 2% up to 10%, or even higher. The expert in practical math knows when 10% is close enough for his purposes. He also knows when he must be within 1% to be safe, or even within 1/10 of 1%. Being too accurate for the purpose in hand marks the tyro with figures.

Here's a sample of wasted accuracy: You want to buy a piece of rope to wrap five times around a 6-ft tank, with a bit to spare. Diameter of the center line of the rope coils is the tank diameter plus the rope diameter. Some would add these, then multiply by 5 and by 3.1416 like this:

$6 + 0.04 = 6.04$; $6.04 \times 3.1416 \times 5 =$ 94.88 sq ft

Considering the purpose, this operation doesn't make much sense. Why not forget the trifling rope diameter? And why not take 3 as the value of pi here? Then the rope length needed will be about $5 \times 6 \times 3 = 90$ ft. So to be on the safe side you buy 100 ft.

School teachers do a lot of harm when they teach boys and girls to use 3.1416 as pi for all occasions. Even worse is the figure 3 1/7, taught in some schools. I could write a book about what's wrong with 3 1/7. Pi should be 3.1416, 3.141, 3.1 or just 3 according to the accuracy needed for the particular job.

REMEMBER THESE NUMBERS

As handy tools for freehand figuring always keep a few approximate constants in your head. Pick them to meet your own needs. According to books, the area of a circle is 0.7854 times the square of the diameter. This is nothing but 3.1416 divided by 4. To put it another way, the area of a circle is 78.54% of the area of the square it fits in.

Here again it would be very foolish to use 0.7854 for all occasions. Much of the time 0.78 is close enough. And it happens every now and then that the purpose at hand is served if the area of the circle is taken as either three-quarters of the square or 0.8 of the square, whichever is easier to use.

Find the approximate area of a 60-ft diameter circle. The square is 3600 sq ft. Three-quarters of 3600 is 2700. Call it 2800 sq ft.

Find approximate area of a 50-ft-diameter circle. The square is 2500. Then $2500 \times 0.8 = \frac{1}{4} \times 8000 = 2000$ sq ft, approximate area of 50-ft circle.

Since engineers work a lot with water and common metals it is convenient to remember the constants in the table below.

Now for some more free-swinging practice problems: How many gallons in a hogshead if the height is 5 ft, center diameter 5 ft, and top and bottom diameters 4 ft?

Take the average diameter as 4.5 ft. First step is to square this diameter. Roughly $4.5 \times 4.5 = 4 \times 5 = 20$ sq ft. Three-quarters of 20 is 15, approximate area of average section of the hogshead.

Volume, then, is $5 \times 15 = 75$ cu ft. Capacity in gallons is about $75 \times 7.5 =$ about $80 \times 7 = 560$ gallons.

The statement that $4.5 \times 4.5 = 4 \times 5$ involves little error. We find that 4×5 is 20 while 4.5×4.5 is 20.25, only 1% higher.

The rule is this: The product of a number by itself may be replaced by the product of two numbers, one slightly higher than the original number and the other the same amount lower.

Example: What is the area of a plot 212 ft square? Roughly $212 \times 212 = 200 \times 224 = 44{,}800$, say 45,000 sq ft. Exact area is 44,944.

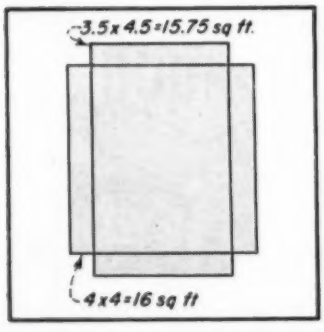
The same idea operates in reverse. Instead of moving the two numbers apart they may be moved together. Here is the rule: If two numbers are nearly equal (say within 25%) their product is about the same as the square of their average.

Example: What is the area of a table top 3.5×4.5 ft? A square table of the same average dimension would be $4 \times 4 = 16$ sq ft. The exact area of a 3.5×4.5 table is 15.75 sq ft, Fig. 1.

Here I must sound a note of warning: Don't try to apply this method if the two dimensions differ widely. Take the case of a table 1.5×4.5 ft, 3 times as long as it is wide. Here the average squared would be $3 \times 3 = 9$ sq ft, whereas the actual area of a 1.5×4.5 table is 6.75 sq ft, Fig. 2.

On the other hand, this shortcut never gives an error of more than 1% if the two dimensions differ by not more than 20%.

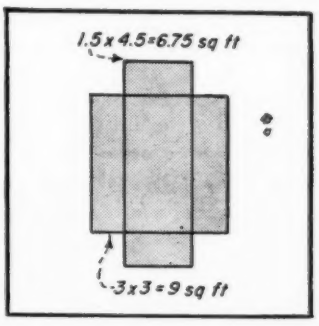
Proof by trial: Find exact and approximate area of a plot 90x110 ft. True area is 9900. Approximate area $= 100 \times 100 = 10{,}000$ sq ft, which is an error of 1%.



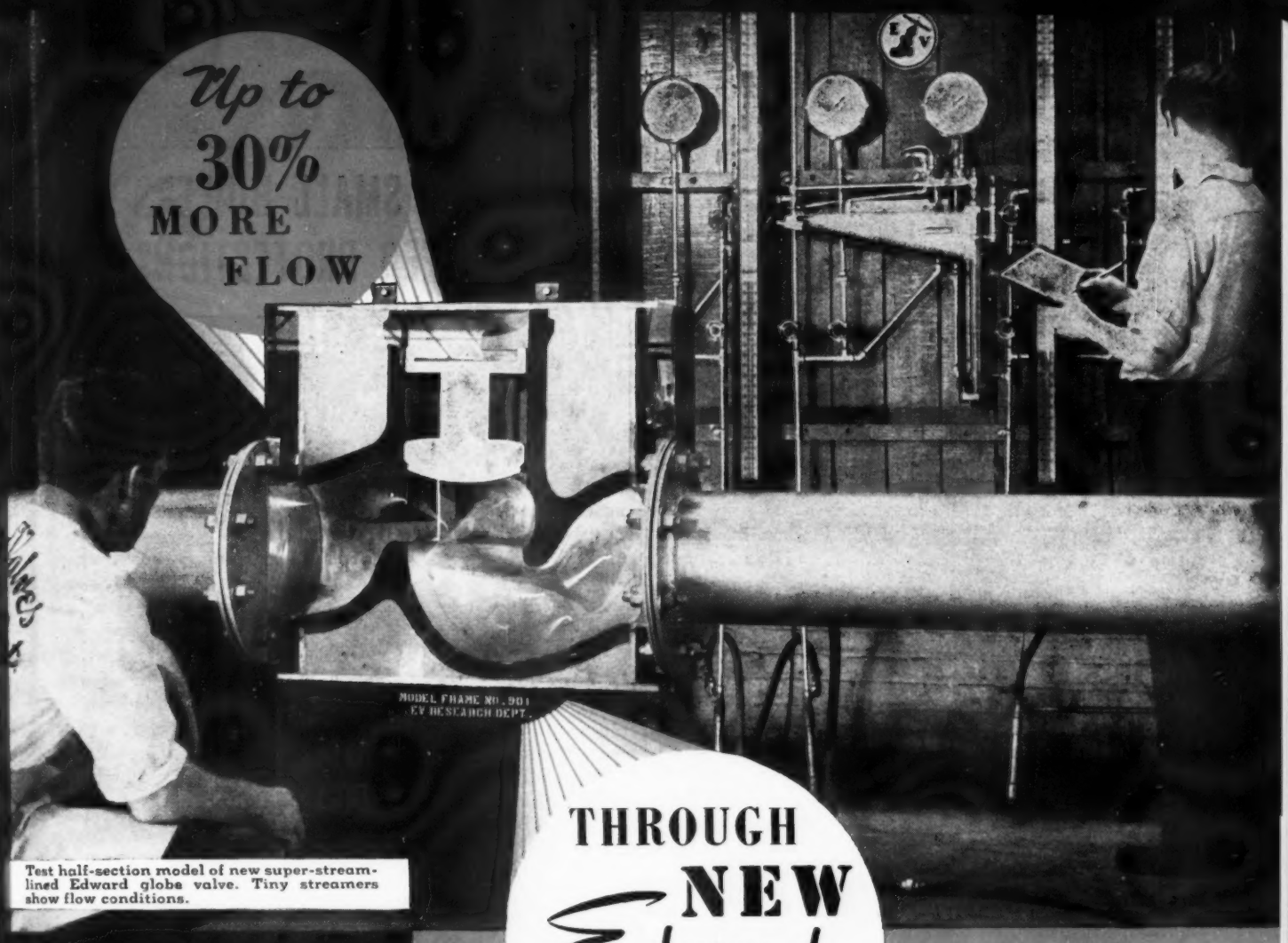
CONSTANTS OF WATER AND COMMON METALS

	Close	Rough
Cu in. per gal of water	231	230
Weight cu ft water, lb	62.4	62 or 60
Gal in a cu ft, water	7.5	....
Weight cu in. cast iron, lb	0.26	0.25
Weight cu in. steel, lb	0.28	0.3
Weight cu in. brass, lb	0.31	0.3
Weight cu in. copper, lb	0.32	0.3

Fig. 1—Square table of same average side length has about same surface as rectangular table. Fig. 2—Relation in Fig. 1 doesn't hold for long, thin rectangle



Up to 30% MORE FLOW



Test half-section model of new super-streamlined Edward globe valve. Tiny streamers show flow conditions.

THROUGH NEW Edward VALVE DESIGNS

This is the embryo stage of a new Edward Valve—a full scale half-section model. It's hooked up to a flow and pressure drop recording test line, with half the piping at each end of the valve model sectioned and sealed off. Pins bearing yarn streamers are stuck into the plastic, which is frozen in the desired contours and sealed off with a thick transparent plate.

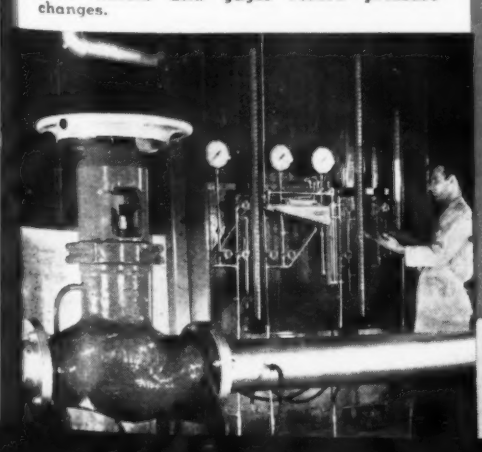
When an air current is blown through the model, *you SEE what goes on.* You can *see* (and record) where turbulence steals pressure. You can *see* where inside contours may need reshaping to provide ideal flow and minimum loss of pressure.

From this model, core sections of plaster and wood are made—the first step in development of patterns for *valves designed from flow tests.*

Most important of all, you see clearly why Edward Flow Testing produces valves that increase flow by as much as 30% compared to the accepted performance of similar valves and, of course, greatly decrease wear-producing turbulence.

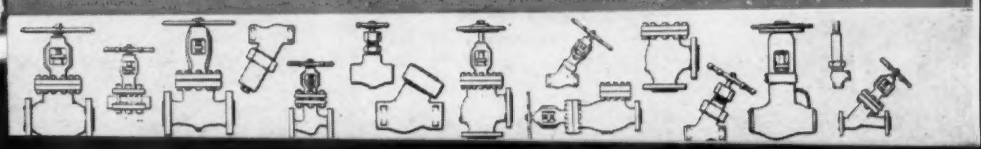
Above—Casts of core sections of model guide pattern design for new high flow rate Edward valves.

Below—Finished 10 in. Fig. 4006 Edward globe non-return valve with Equalizer under test. Flow meters and gages record pressure changes.



Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO EAST CHICAGO, INDIANA



WATER-TREATMENT QUESTION BOX

DO SMALL BOILERS NEED PROTECTION?

By Dr R C ULMER, E F Drew & Co Inc

▶ THIS QUESTION, the fourteenth in a series on water conditioning, comes from the files of Dr R C Ulmer, technical director, Power Chemicals Division of E F Drew & Co Inc,

Goodwater Laboratory
Drum City, U.S.A.
Dear Chemist:

Considerable publicity is always given to feedwater problems on large high-pressure boilers, but very little attention is given to the thousands of small units. What treatments prevent scale and corrosion in these?

Yours truly,
Walter Tender

Dear Walter:

Much interest and attention has justly been focused on water treatment for large boilers, especially if they operate at high pressures (above 50 psi). In smaller plants, which usually operate at low pressures (below 50 psi), the subject is often disregarded entirely or at least until some operating difficulty occurs.

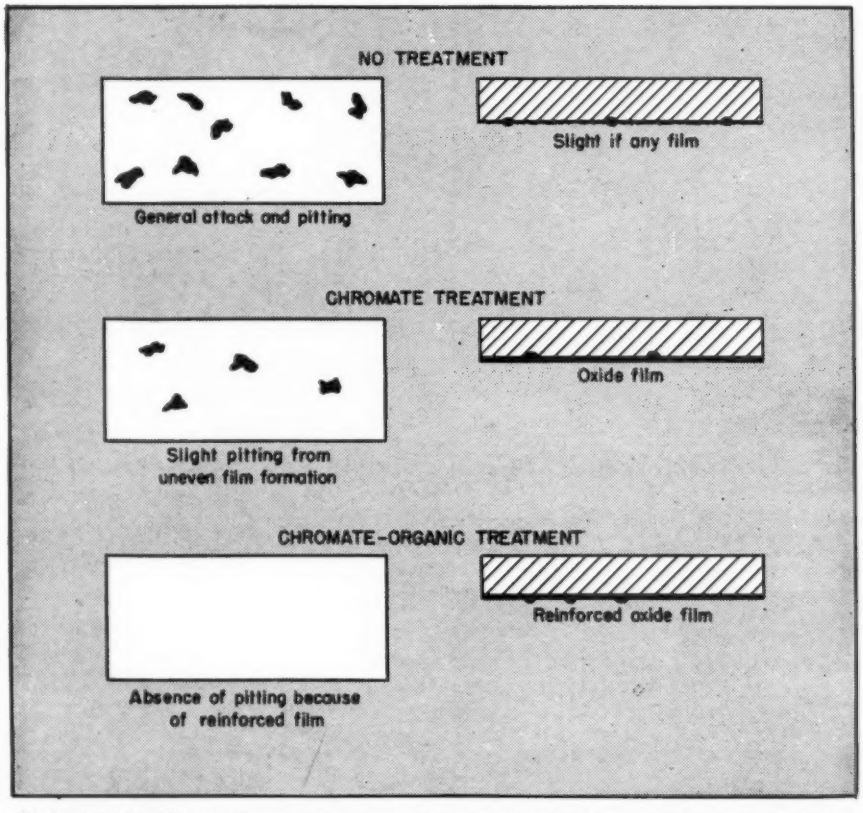
From a practical standpoint, all waters normally used in boilers contain sufficient contamination to cause corrosion and scale formation. Corrosion is caused by oxygen and carbon dioxide, both of which may come from contact with air. Electrolysis, or stray electric current, is a less common cause of corrosion. Scale formation is caused by hardness salts coming out of solution as the result of heat and concentration of minerals dissolved in the water. Priming and carryover may occur if too much concentration takes place in the boiler.

The corrective steps may be carried out inside or outside the boiler. Because of the small amount of water usually involved, external treatment (softening) is seldom used. Proper alkalinities and pH should be maintained to keep corrosion at a minimum, and some scale-preventive treatment may be necessary. If makeup is large, the usual hardness-precipitating chemicals, such as phosphates, alkalies, etc, are used.

Since a small amount of makeup usually is involved, a combination scale- and corrosion-preventive treatment involving a chromate-organic colloid combination is used. The chromate forms a protective film on the metal surface which prevents corrosion. Chromate in the presence of a proper organic colloid is much more effective than chromate alone as the organic "plugs" any holes in the film. In addition, the organic colloid also coagulates any hardness salts that precipitate, maintaining them in a nonadherent condition. Thus corrosion and scale are eliminated. Priming or carryover usually are not bothersome unless makeup is large. If this is the case, proper blowdown must be practiced to eliminate these dangers.

A serious corrosion problem not concerned directly with the boiler, may occur in the steam and condensate piping if sufficient carbon dioxide is present to cause the steam to have a low pH. This is true especially if soda ash, which decomposes to yield carbon dioxide, is used as treatment. Fortunately, the occurrence of low pH steam can be eliminated by using volatile alkaline materials in the boiler that vaporize with the steam and neutralize any acidic material present.

Yours truly,
Chemist
Goodwater Laboratory



Chromate in the presence of a proper organic colloid is much more effective than chromate alone because the organic material covers the holes in the film

ANKORITE ASBESTOS WICK and ANKORITE ASBESTOS ROPE

will prove their worth in any plant!

"ANKORITE" Asbestos Wick and "ANKORITE" Asbestos Rope will meet many needs in large and small Power Plants throughout the nation.

"ANKORITE" Asbestos Wick is supplied in pound balls. The Wick is formed from twisted strands which may be untwisted to form smaller sizes for many uses.

"ANKORITE" Asbestos Rope is furnished on reels—25 or 50 lbs. each—in sizes ⅜" round to 1½" round. The strands of Asbestos Rope may also be untwisted to form smaller sizes.

Suggested Uses

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FOUNDRY MOLDS
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169 West Jefferson Avenue	Detroit 26, Michigan
509 Washington Avenue	Houston 2, Texas
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418 Common Street	New Orleans 4, Louisiana
100 6th Avenue	New York 13, New York
401 North Broad Street	Philadelphia 8, Pennsylvania
405 Penn Avenue	Pittsburgh 22, Pennsylvania
Terminal Sales Building	Portland 1, Oregon
156 South Park	San Francisco 7, California
2207 1st Avenue South	Seattle 4, Washington
1407 Pine Street	St. Louis 3, Missouri
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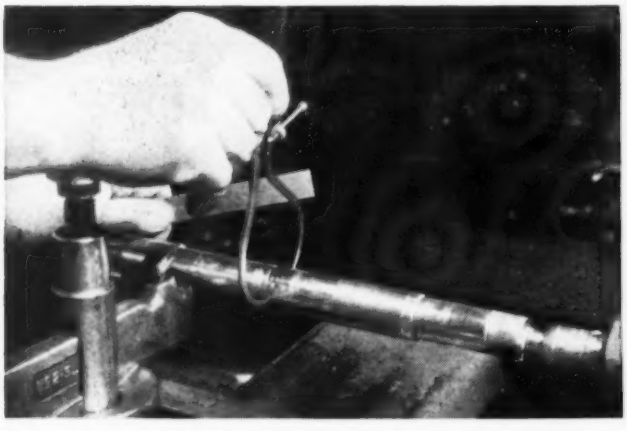
HOW TO RECONDITION WORN SHAFTS AND RODS

▶ WHERE MACHINE RODS and shafts wear at packing glands, bad areas must be repaired or the part replaced.

Wear comes from too much friction. Keep it low by using a good grade of packing and adjusting gland evenly. Make sure gland followers do not ride on rod or shaft; let just enough leakage seep through to keep packing lubricated. When it becomes hard and dry, replace at once instead of trying to stop excessive leakage by further tightening of the packing gland.

If a new shaft or rod is costly, or wear is rapid, it generally pays to add a tougher wear-resisting material to the point of rotating or sliding contact, as shown below.

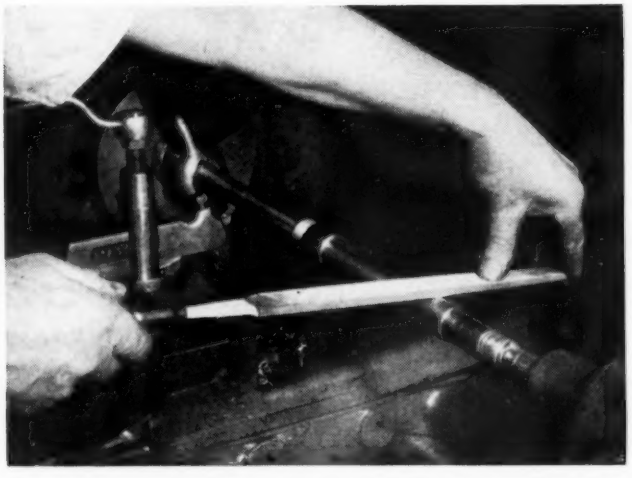
Photos 1, 2 *and* 4, *courtesy of International Nickel Co; photo* 3, *courtesy of Metallizing Engineering Co, Inc.*



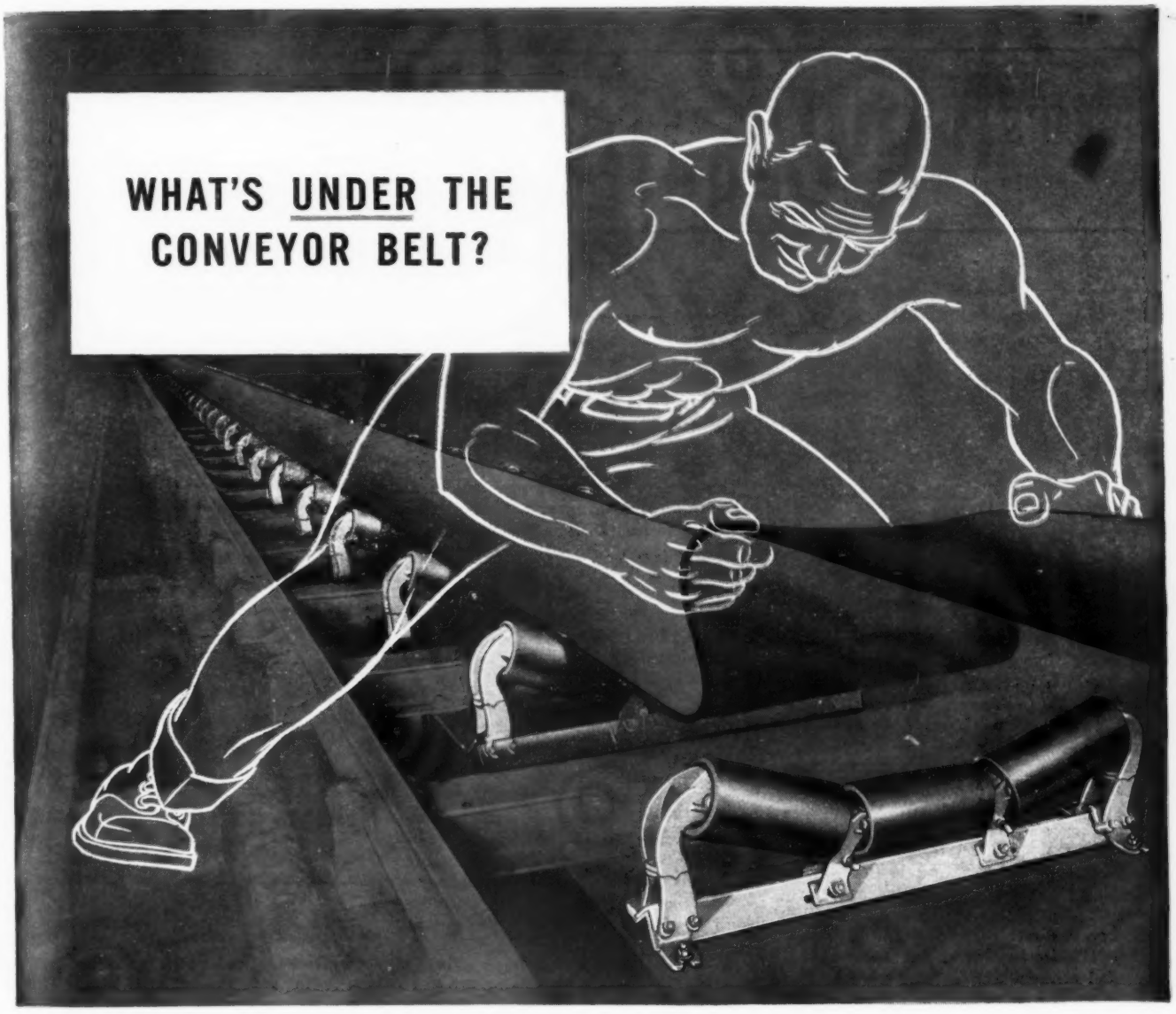
1 Center the piece in a lathe in preparation for machining off the worn area. If the shaft is long and small in diameter, support it in a steady rest located near the point of work. Measure any unevenness with calipers to determine depth of cut that will give proper thickness of metal overlay. In preparing for metal spray see Fig. 3.

3 Success of build-up by metal spraying depends to a great extent on how the surface is prepared (POWER, April 1945, p 122). When applying metal to the undercut or dovetail section at each end of the machined area, direct the gun by hand. Otherwise, mount it in the tool post with the nozzle about six inches from the work.

2 When build-up is done by welding, keep the heat low and lay the bead longitudinally along the shaft. For 2-in. shafts and smaller, alternate the beads at 180-deg positions. On larger shafts lay second bead 180 deg from the first, third at 90 deg or midway between the first two. Apply the fourth 180 deg from the third and start over.



4 After the overlay is applied, machine off excess metal in a lathe, leaving a few thousandths of an inch for filing and polishing to the final size. Apply the file lightly, moving it back and forth as the shaft revolves. Polish the area with fine emery cloth, performing the operation in the same direction that the piece will move in service.



The all-important question in belt conveyor design

A look under the belt of the conveyor system you propose buying can be one of the most profitable inspections you ever made.

For the carriers under the belt largely determine the efficiency and economy of the entire system.

See, for example, how you benefit with correctly designed S-A "SACON" carriers as shown above.

You save on bearing travel, bearing life and on starting and running power because the "live" shafts turn with the rollers in ball or roller bearings.

You save on maintenance, because bearings are enclosed in dust and moisture tight self-aligning housings, with labyrinth grease seals... and because Sacons are expertly designed and are ruggedly built of the finest materials... *to keep the belt rolling.*

You save in many other ways with the complete Stephens-Adamson line which includes belt conveyor accessories and carriers specifically designed for every type of Service.

For full information on the conveyor equipment best suited to your needs, get in touch with an S-A engineer or write us direct.

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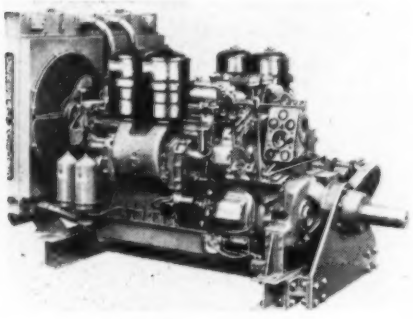
BULK MATERIAL HANDLING EQUIPMENT

WHAT'S New IN PLANT EQUIPMENT



Industrial Diesels

SERIES 71 TWIN-6 UNITS consist of two basic General Motors 6-cyl 2-cycle engines, mounted side by side and geared to a single shaft. Continuous bhp at 1800 rpm is 276 with a maximum intermittent rating of 400 bhp at 2000 rpm. Any one of four different power takeoff arrangements may be had: (1) heavy-duty takeoff (*shown*) stands pulley and chain-drive side thrust without need for cradle-mounted sheave or sprocket (2) stub-shaft takeoff fits any of various coupling types used in heavy-duty machinery (3) drive-flange takeoff is suitable for installations where driven machinery is direct connected, and (4) the SAE "O" size housing supports any close-coupled power takeoff within proper horsepower range and is particularly suited for application with torque converters. Gear ratios of 1:1, 1.33:1, 1.77:1 and 2:1 are available with each type of takeoff.

Engine units can be obtained with radiator or heat-exchanger cooling systems; specially designed flanges can be furnished for installations employing remotely located radiators or cooling towers. On the new *Twin* models dual electric starting motors are optional. Units are offered with right-hand or left-hand rotation. **Dept P, Detroit Diesel Engine Div, General Motors Corp, 13400 W Outer Dr, Detroit 23, Mich.**

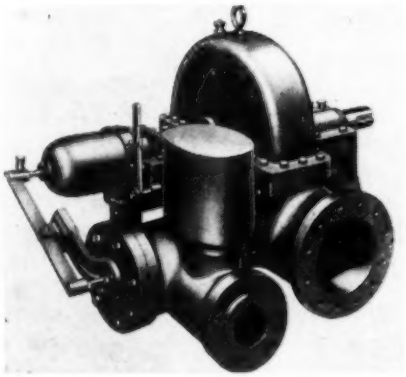
Level Control

THE 10CB1X level-control instrument works on a unique principle in which contact with the liquid is made only by stainless-steel probe rods. No floats or other moving parts are required in the tank. Accuracy is independent of temperature and pressure. The 10*CB1X* unit is an ac control that combines a probe circuit and transformer to operate a dc relay. Two probe rods project into the tank at levels corresponding to low and high points where pumping is to start and stop, respectively. When liquid rises to upper probe level, fluid acts as a conductor, thus closing circuit for operating a relay. Pump is stopped when fluid drops and electrical circuit opens.

The level control comes mounted in an explosionproof housing or a pressed steel dust-tight inclosure. It is made to operate on 115- or 230-v 25/60-cycle ac. It has a 2-amp rating at 115 v or 1 amp at 230 v. Four terminals on panels make it possible to match probe current to electrical conductivity of liquid controlled. **Dept P, Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass.**

Radiator Valves

TRANE NO. 44 LIFETIME HERMETIC VALVE carries a lifetime guarantee against stem leakage, according to the manufacturer. Stem packing is eliminated by a metallic sealing diaphragm. Stem and diaphragm movement are kept small through a system of multiplying levers interposed between diaphragm and valve disk. The valve can be used for steam or hot water service. **Dept P, Trane Co, La Crosse, Wis.**



Mechanical-Drive Turbines

IMPROVED LINE OF YR mechanical-drive turbines has all features of Elliott *Y* line of turbines. The new turbines incorporate increased capacities up to 2000 hp, higher initial steam pressures and temperatures, higher backpressures through 250 psig, and speeds through 6000 rpm. Full advantage has been taken of new materials and construction techniques. The turbines have been made suitable for installation outdoors by sealing the bearings and completely inclosing governor parts. Maintenance costs have been reduced by standardizing parts, enabling their use on two or more frames. In addition, simplifying parts, such as main bearings, reduce replacement costs. **Dept P, Elliott Co, Jeannette, Pa.**

Master Switch

THIS SWITCH is of extra sturdy construction to minimize maintenance under severe service.

Seven important and desirable features of this switch are: (1) It has 48 deg of travel from first point forward to first point reverse in switch handle position. This makes 24 deg of travel from "off" to first point in either direction. (2) Offset handle construction makes it possible to group three or four units with only 7-in. distance between handle centers. (3) Switch has a hardened camshaft mounted on needle bearings. *Bakelite* cams are bolted in position and complete assembly has unusually wide electrical clearances. Entire cam assembly can be removed as a unit. (4) There is a hardened star wheel and roller with an adjustable return spring. (5) It has movable double-brake silver contacts that are spring closed and mechanically opened. Contacts are easily removed from guides by pressing down and turning 90 deg. (6) The inclosure is split at bearing line for easy maintenance. It is of dust-tight construction, and has a shallow box and deep cover with liberal space for internal wiring. (7) Entrance conduits are 1¼ in., conveniently located. Bosses are large enough for redrilling and tapping for 1½ in. **Dept P, Square D Co, 4041 N Richard St, Milwaukee 12, Wisconsin.**

(*Continued on page* 128)

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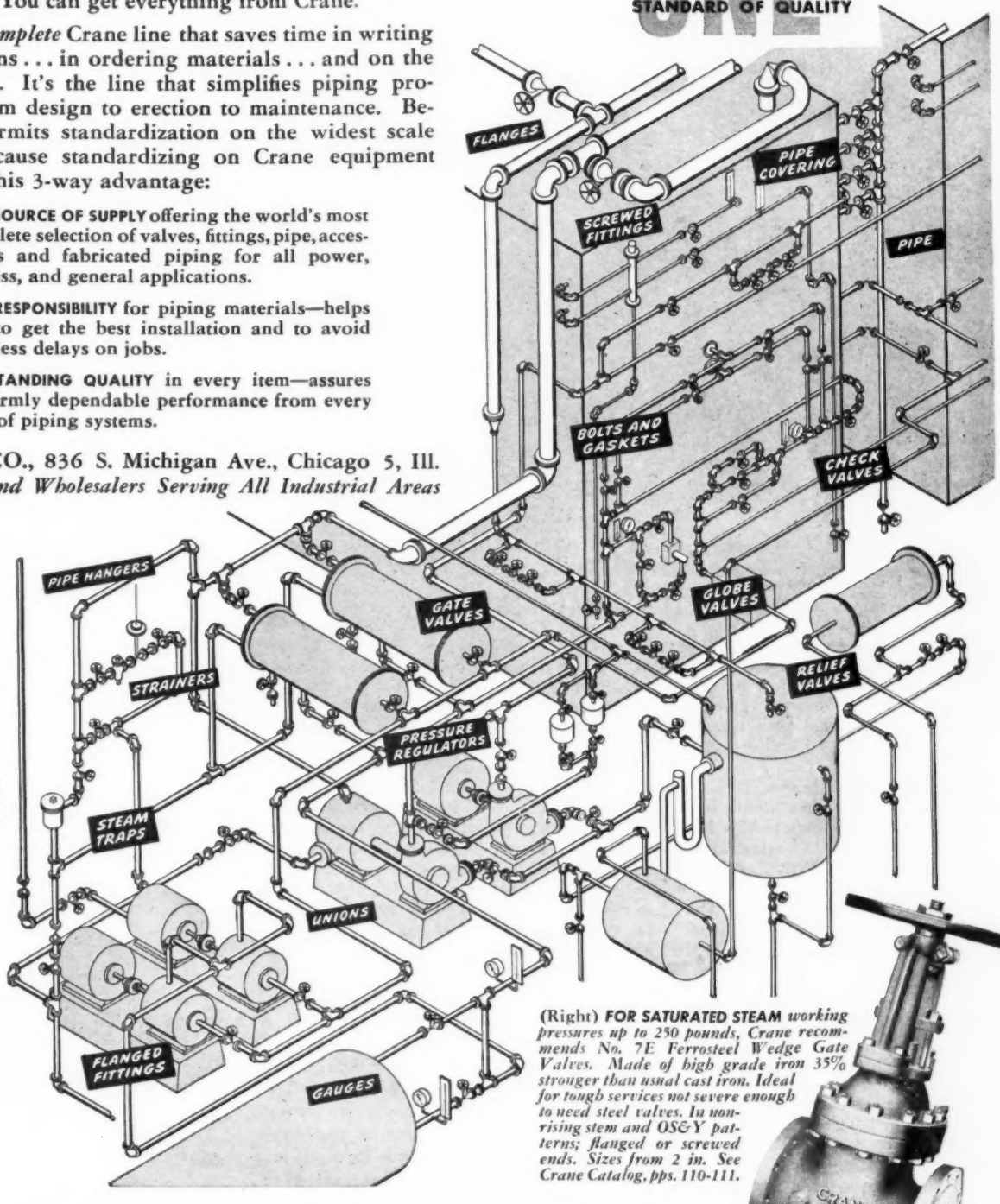

Fuel, water and condensate piping to oil-burning boilers.

(Right) **FOR SATURATED STEAM** *working pressures up to 250 pounds, Crane recommends No. 7E Ferrosteel Wedge Gate Valves. Made of high grade iron 35% stronger than usual cast iron. Ideal for tough services not severe enough to need steel valves. In nonrising stem and OS&Y patterns; flanged or screwed ends. Sizes from 2 in. See Crane Catalog, pps. 110-111.*

EVERYTHING FROM . . .

VALVES • FITTINGS
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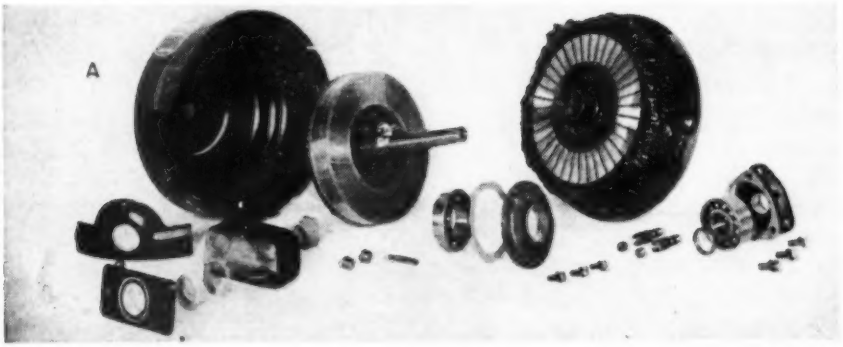
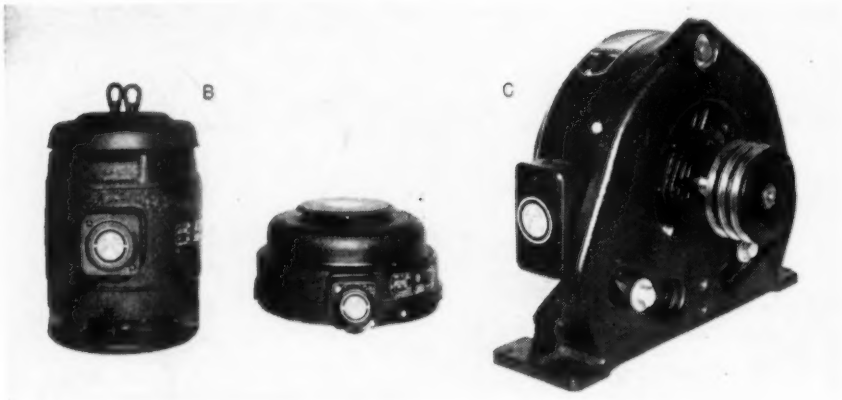
FOR EVERY PIPING SYSTEM





MOTOR WITH AXIAL AIR GAP

PRINCIPLES OF THIS motor are entirely new. It is distinguished by the fact that the magnetic lines of force follow a path parallel to shaft, or axis of rotation, as compared to a radial path taken by the magnetic flux in the so-called conventional motor. Details of motor are shown in exploded view at *A* above.

This new line ranges in size from ½ to 10 hp. Motors are suitable for horizontal or vertical flange mounting, or on an angle base for belt drive as at *C*. The outstanding features are space and weight reduction. The new motor is less than half the size of the conventional type motor (see *B* above). It retains all the necessary characteristics of sturdiness and power requirements. Other unique features, in addition to improved appearance, are simplicity of construction and ease with which this motor can be inspected, cleaned and lubricated. It has a cooler rotor and is easy to apply as flange-mounted because of less overhang, thus it offers unlimited machine application. It is particularly adaptable to mounting on machine tools, gear units and other machines where compactness and a streamlined appearance are desirable. It is ideally suited for gear motors, mounted as an integral part of unit. **Dept P, Fairbanks, Morse & Co, Chicago 5, Ill.**

Open-Type Fuse Cutout

A NEW DESIGN of drop-out fuse holder, for distribution circuits of 15,000 v and below, provides overcurrent protection throughout full range of fault current up to the 2000-amp rated capacity. This unit has bird-proof construction, obtained by placing mounting hardware and live parts on opposite sides of the solid porcelain insulator. Mounting support is cemented securely in insulator. Mechanical and electrical qualities of this unit have been thoroughly tested by wet and dry flashover tests, short circuit tests, tension tests of metal to porcelain joints and accelerated life tests.

This cutout is available in three voltage ratings: 5000, 7500/12,500 grounded "Y," and 15,000 v. It has a continuous current rating of 100 amp. It can be fused with conventional or *Hi-surge* fuse links. Mounting hangers provide for vertical, angle-tilted and swivel position of the cutout. It is also built for combination cross-arm mounting of the cutout with standard distribution lightning arresters. **Dept P, General Electric Co, Schenectady 5, N. Y.**

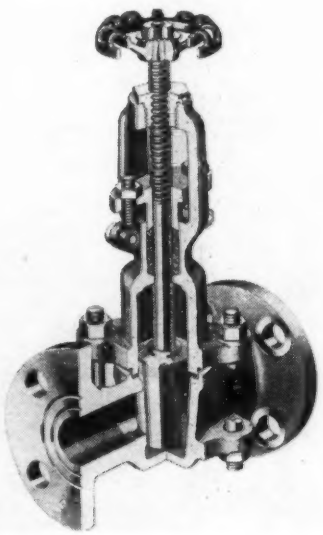
Watercooled Conductor

DESIGNED FOR TRANSMISSION of high power, high-frequency current, this conductor consists of a convoluted brass water-tight inner core with an outer braid conductor. A specially compounded high-frequency flexible insulation is extruded over the outer braid. Conductor provides a flexible circuit that is watercooled for minimum losses at high power. Its special insulation is suitable for high-frequency current. The insulation is flexible and tough, and has excellent dielectric properties. It is also resistant to water and chemicals.

Flexibility of the conductor permits freedom of motion between component parts. Conductor is especially applicable on high-frequency equipment or other applications where it is necessary to carry a large amount of power. **Dept P, Titeflex, Inc, 595 Frelinghuysen Ave, Newark 5, New Jersey.**

High-Strength Belt

RUBBER-FABRIC CONVEYOR BELT, of high strength for conveying coal, iron ore and other bulky materials over long distances, is built with nylon and *Ustex* yarn fabric. In addition to its greater strength, the belt has low lengthwise stretch and increased crosswise flexibility, both of which permit building longer and heavier belt conveyors. The belt can be made endless or repaired in the field by conventional methods. **Dept P, U. S. Rubber Co, Rockefeller Center, New York, N. Y.**



Gate Valves

NEW DESIGN OF PLUG GATE VALVES provides straight-through flow in the wide-open position, yet they are suitable for throttling service. The valves offer little resistance to

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P

Let Trouble be our Introduction

THERE'S nothing like trouble to bring people together. That's how some of Revere's closest friends were gained—through a mutual struggle against difficulties, troubles such as occasionally beset any business.

Take the case of an important product, originally developed for war uses, now finding many applications in peacetime services. When manufacture began, rejections ran extremely high, over 40%, costs were skyrocketing, and badly-needed production was being lost. The maker asked if we would care to collaborate in solving the problem. Of course we would! After studying the subject in detail (and also under conditions of the greatest secrecy), we suggested a radical change in the properties of a non-ferrous metal used in the manufacture of the vital part with which so much trouble was being experienced. New processes of manufacture were developed, and in a short time test runs of the recommended material proved successful. Rejections of finished units dropped to less than 1%. Thus an expensive and vexing bottleneck was broken, and we gained a new customer and a firm friend.

This success story demonstrates that Revere has an open mind as well as an informed one, and is always ready to question the customary, find new answers to new problems, or to old ones, for that matter. If something is worrying you in your employment of non-ferrous metals, get in touch with Revere, not for ready-made answers, but for wholehearted cooperation, a joint search for better results. This help is given freely, without obligation, through the Revere Technical Advisory Service, which has at its command the knowledge and facilities of our laboratories, and the accumulated experience of the entire Revere organization.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

Equipment *Continued*

flow in the wide open position, but permit very close throttling at high and low velocities.

Of outside screw and yoke design, valves have bolted bonnet joints and are available with screwed or flanged ends in sizes from ½ to 2 in. They are available in 18-8 or Monel metal. **Dept P, Crane Co, 836 S Michigan Ave, Chicago 5, Ill.**

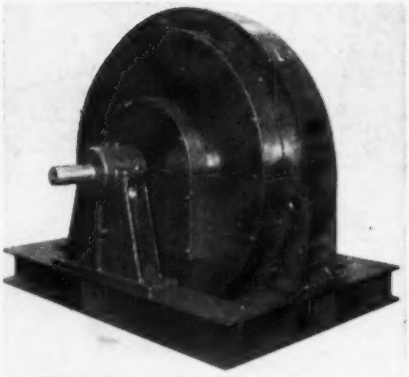
Combustion Control

MODEL 111 photoelectric combustion control provides automatic control of combustion conditions in steam boilers so smoke and soot are greatly reduced and efficiency increased. In operation, smoke present in the flue or breeching, caused by insufficient supply of air, intercepts a light beam. This operates a relay that can then be used to start blowers, open air or steam valves, or give a warning signal. Relay is released a certain time after the disappearance of smoke, and this time delay adjusts itself in accordance with density of smoke that originally actuated it. A meter indicates smoke density at all times. Closing of relay is slightly delayed to prevent operation of blowers, whenever a small piece of soot momentarily intercepts light beam. **Dept P, Furst Electronics, 800 W North Ave, Chicago 22, Ill.**

Storage Battery

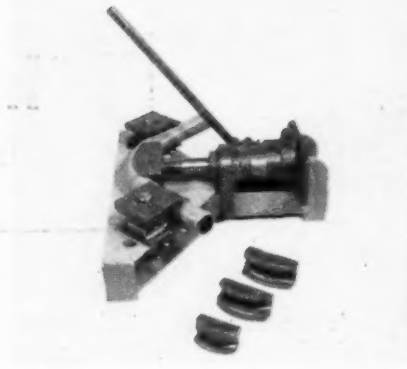
CADMIUM-NICKEL alkaline storage battery accepts high- or low-charge rates with no finish rate limitations, states its manufacturer. It is also reputed to have excellent capacities at low electrolyte temperatures and a low internal resistance.

Battery is constructed of heavy, nickel-plated steel with the active material held in perforated steel pockets to prevent shedding. **Dept P, Baker & Co, Newark 5, New Jersey.**



Splashproof Motor

FOR PLANTS, such as the pulp and paper industry maintains, low-speed synchronous motors are made splashproof. Simple end-shield design makes it easy to remove and assemble cover when inspecting motor. Pedestal bearings are outside of housing, thus permitting regular inspection of oil supply and bearing operation. Construction saves floor space, as frame has louvered openings for side air discharge instead of the flared-skirt type of opening. The conduit box is included in frame structure of motor to protect it from splashing liquids. An inspection window in air chute permits viewing the brushholder and collector ring without removing cover. **Dept P, General Electric Co, Schenectady 5, N. Y.**



Pipe Bender

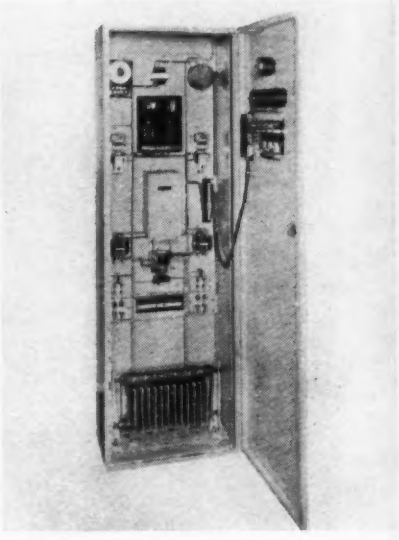
PORTABLE HYDRAULIC PIPE BENDER is light and simple to use. It comes complete with a hydraulic jack that has screw extensions for maximum bends. Dies and ram extensions for 180-deg bends can be furnished. Two sizes are available: The 24-in unit comes complete with ¾-, 1-, 1¼- and 1½-in. dies. The 30-in. unit comes with 1½-, 2-, 2½- and 3-in. dies. All parts of the *Aujax* pipe bender are electric welded and heavily reinforced. **Dept P, Electric Cord Company, 30 Church Street, New York 7, N. Y.**

Vibrating Screen

INCLINED, FLOOR-MOUNTED or spring-and-cable suspended screen gives effective sizing, its manufacturer claims, for a variety of materials. The *CA*, a two-bearing balanced vibrator mechanism, imparts a concentric or circular vibrating motion to all points in the screen. **Dept P, Link-Belt Co, 307 N Michigan Ave, Chicago 1, Illinois.**

Resin Zeolite

LIQUONEX CR RESIN ZEOLITE is a cation exchange material that has high capacity and permits high flow rates per sq ft of softener area. The material is nonsiliceous and does not impart silica to the treated water. **Dept P, Liquid Conditioning Corp, 114 E Price St, Linden, N. J.**



Peak-Load Control

PEAK-TROL OFFERS a flexible and reliable way of controlling off-peak loads at any time that a peak load occurs. Off-peak loads are not bound by a rigid preset time schedule but can be automatically controlled when load peak demands it.

The *Peak-trol* signal is inserted into distribution system along same circuit used to supply power. Intermediate transformers do not stop or reduce effectiveness of signals. Control signal is unaffected by distance or power-factor correction equipment that may be added. *Peak-trol* is not a carrier current system; it covers all parts of the system without "dead spots" at any point.

It is easy to pick up a circuit after an outage because a few seconds after a circuit is out all *Peak-trol* receivers drop their load until an "on" signal is sent out. This does not affect the load on other circuits which had no outages. If trouble occurs

(*Continued on page* 140)

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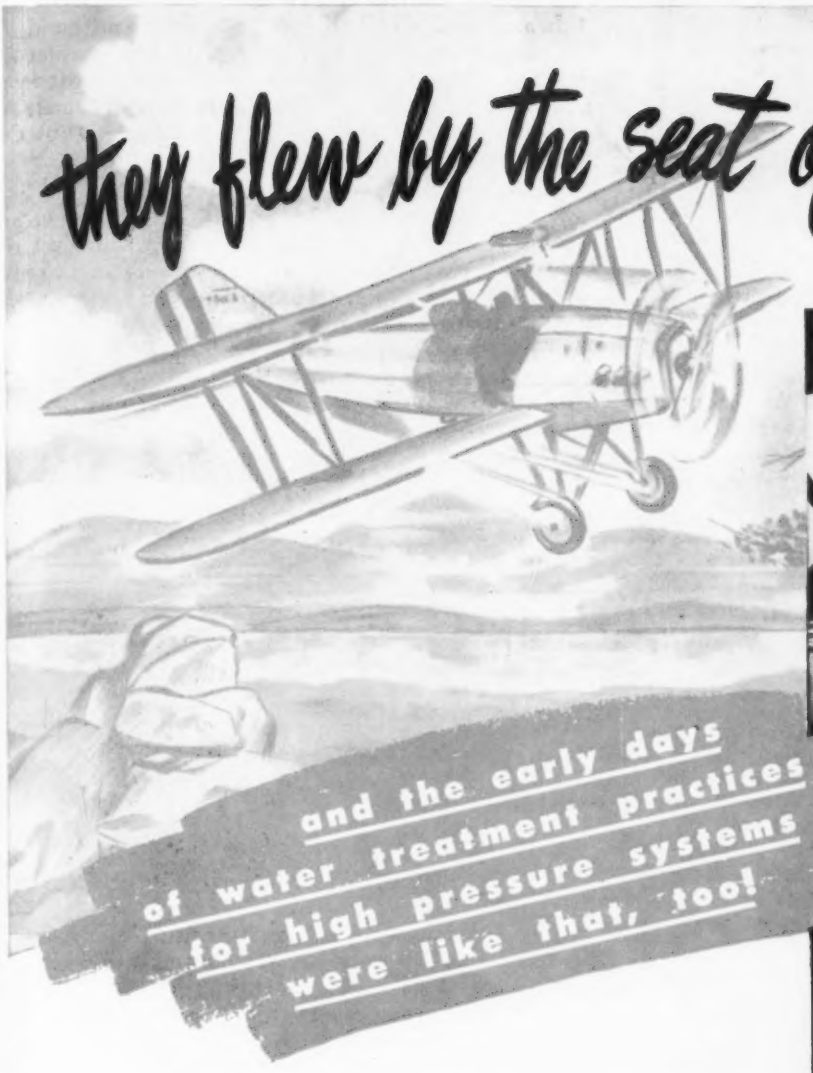
they flew by the seat of their pants...



and the early days of water treatment practices for high pressure systems were like that, too!

They flew by the seat of their pants—the airman's term for flying half by instinct, half by visible results. Those days are gone, but the experience gained by the seat-of-the-pants fliers has made today's precision flying possible.

And there is a close parallel in the treatment of water for high pressure steam systems. First efforts were trial and error . . . guessing on the basis of past experience with lower pressures, and a recognition of bigger problems to come in the future.

Nalco chemists and engineers were among the first to tackle water treatment problems for high pressure systems . . . and the accurate methods of Nalco treatment and control available to high pressure plants today are a direct result of this early pioneering research.

Write today for details of a Nalco Survey for your plant. High pressure or low, the Nalco System maintains *permanent* water treatment results.

At top—*A modern aircraft instrument panel would only have confused the seat-of-the-pants flier — but it makes today's flight safer, surer — because of his early efforts.* Bottom—*The Nalco General Laboratory, part of the world's largest water treatment laboratories . . . where original research and layout of precision control methods go forward continuously toward the goal of perfect water treatment.*

NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place, Chicago 38, Illinois

Canadian inquiries should be addressed to
Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto 8, Ontario.

The Scientific System of Water Treatment for All Industry

nalco

How to plan a

SURFACE CONDENSER WITH TWO STAGE STEAM JET AIR EJECTOR

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

WHERE exhaust steam is not used for heating or in process lines, efficient operation requires the use of high vacuums on prime mover exhausts. Creating a vacuum requires a condenser, and the one in this layout is for use with a high pressure steam prime mover. The cooling water does not come in contact with the exhaust steam, but is pumped through the tubes around which the steam passes and condenses. The condensate can then be re-used in the boiler after heating. The condenser cooling water circuit is provided with a priming ejector for removing the air from the cooling water system. This ejector is shut down during normal operation.

Non-condensable gases as well as air must be removed to maintain the high vacuum. In the two stage steam jet air ejector illustrated here, the first stage partially compresses the low pressure air it sucks from the main condenser and discharges the mixture of air and steam into an inter condenser where the steam is further condensed and trapped back to the main condenser hot well. The air in the inter condenser is then drawn off by the second stage ejector and compressed to atmospheric pressure. This mixture of steam and air is passed through an after condenser where the steam is again condensed and trapped back to the main condenser hot well. The air which is at atmospheric pressure is removed from the system through an air vent or air meter.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

25

Fig. 370
BRONZE GATE VALVE
Solid Wedge
Stationary Spindle

For steam, water, oil and gas lines where full, unobstructed flow is required. In rapidly vibrating currents especially, the solid wedge offers maximum resistance to pressure strains, lengthening service life. When valve is fully open, the wedge entirely clears the pathway, affording flow practically equal to that of the pipe.

The inter and after condensers, separated by a horizontal baffle, are generally constructed within the same shell. The cooling medium is the condensate from the main condenser which then goes to the feedwater heater for re-use, or is returned to the main condenser hot well through a float controlled valve which insures a positive hot well liquid level.

Each stage of the air ejector is provided in duplicate to assure a full load standby at all times. In normal operations only one ejector is used in each stage. The steam supply to the ejectors is usually taken from the high pressure main, with pressure lowered through a pressure reducing valve. In a 450# plant, it is customary to run the ejectors at about 300#. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation. Copies of Layout No. 25 will be furnished on request. Mail coupon.

A CHOICE OF OVER 600 JENKINS VALVES

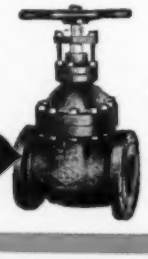
To save time, to simplify planning, to get all advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.: Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

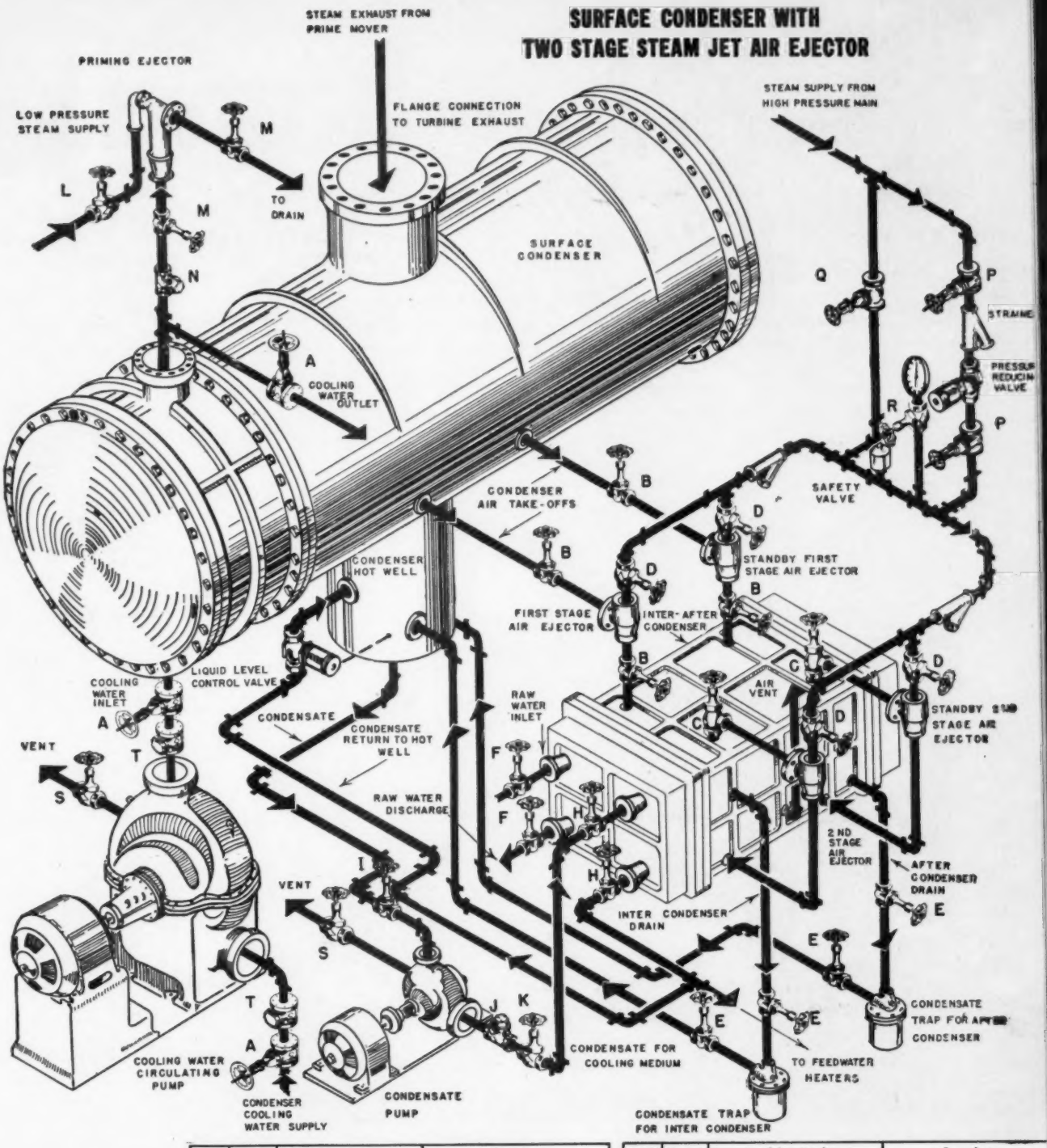
TRADE JENKINS MARK



125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

SURFACE CONDENSER WITH TWO STAGE STEAM JET AIR EJECTOR



PRESSURE GAGE

THERMOMETER

VALVE RECOMMENDATIONS

For details and valves to suit varying conditions see Jenkins Catalog.

Diagram by Huxley Madeheim, Consulting Engineer

Code	Quan.	Jenkins Valves	Service
A	3	Fig. 651 I.B.B.M. Gate	Condenser Cooling Water Shutoff and Supply
B	4	Fig. 370 Br. Gate	Condenser Air Takeoffs Ejector Selector
C	2	Fig. 108-A Br. Angle	Inter CondenserAir Take-offs Ejector Selector
D	4	Fig. 976 Br. Globe	Ejector Steam Connections
E	4	Fig. 370 Br. Gate	Inter-After Condenser Condensate Traps
F	2	Fig. 370 Br. Gate	Raw Water Connections to Inter-After Condenser
H	2	Fig. 370 Br. Gate	Circulating Water for Inter Condenser
I	1	Fig. 370 Br. Gate	Condensate Pump Shutdown

Code	Quan.	Jenkins Valves	Service
J	1	Fig. 92 Br. Swing Check	Prevent Back Flow through Pump
K	1	Fig. 106-A Br. Globe	Condensate Pump Control & Shutoff
L	1	Fig. 106-A Br. Globe	Steam Supply to Priming Ejector
M	2	Fig. 370 Br. Gate	Priming Ejector Shutdown
N	1	Fig. 92 Br. Swing Check	Prevent Back Flow to Condenser
P	2	Fig. 1012 Cast Steel Gate	Pressure Reducing Valve Shutoff
Q	1	Fig. 1046 Cast Steel Globe	Manual Pressure Control
R	1	Fig. 970 Br. Globe	Control Pressure Gauge
S	2	Fig. 106-A Br. Globe	Vents for Pump
T	2	Fig. 295 I.B.Swing Check	Cooling Water Pump

BRONZE • IRON • STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS BROS., 80 White St., New York 13, N. Y.

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Number 180

Caculation Chart: Bolt and Stud Tension

► THIS HANDY CHART helps in tightening nuts to the right degree and achieving uniform loading on bolts and studs. These factors are important in making up high-pressure-steam joints on mains, and pump and turbine casings, where high-strength bolting is required. See POWER, Feb 1946, pp 68-70.

To determine tension or loading, two quantities must be known: the elongation of the stud and its length under tension. Elongation is found from the difference of micrometer readings of total length of stud, loaded and unloaded. Length under tension is the distance L in the diagram. This always equals the sum of the distance between the facing surfaces of the nuts, plus one-half the height or thickness of each nut. Normally nut height equals the nominal bolt or stud diameter.

When these two factors are known they are located on the scales of the chart, and at the intersection of their ordinates the tension is read from the inclined lines. If desired, the procedure can be reversed by first determining from the chart the elongation needed in a bolt of given tension length for a given tension or loading.

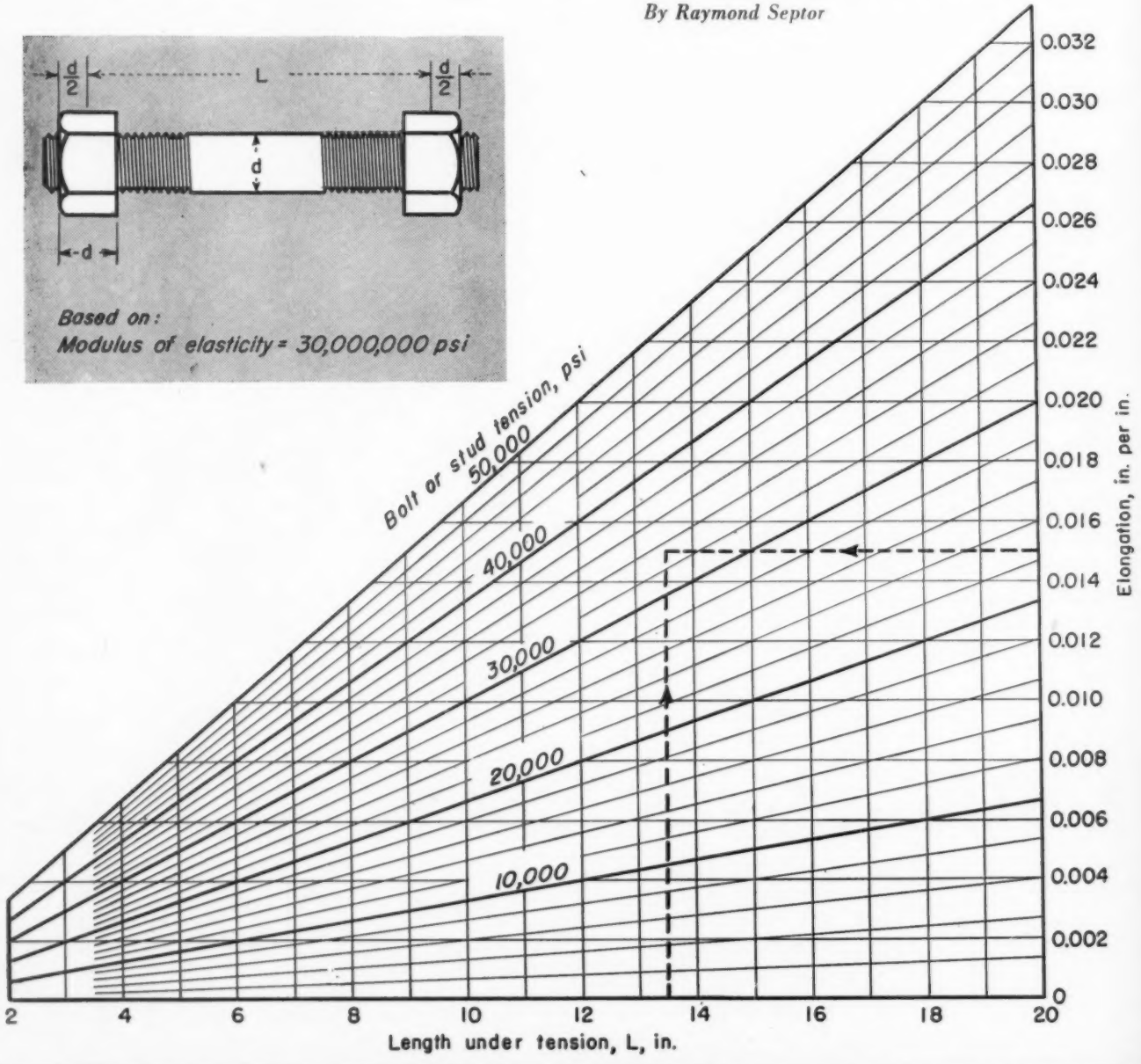
Example: A 1.5-in. stud measures 16.514 in. unloaded, and 16.717 in. when loaded by tightening the nuts. Distance between facing nut surfaces is 12.0 in. Find the tension in the stud.

Tension length = $12.0 + \frac{1}{2} \times 1.5 + \frac{1}{2} \times 1.5 = 13.5$ in.

Elongation = $(16.717 - 16.514)/13.5 = 0.015$ in. per in.

After finding these two values on the chart scales follow the traces to their intersection to read 33,300 psi.

By Raymond Septor



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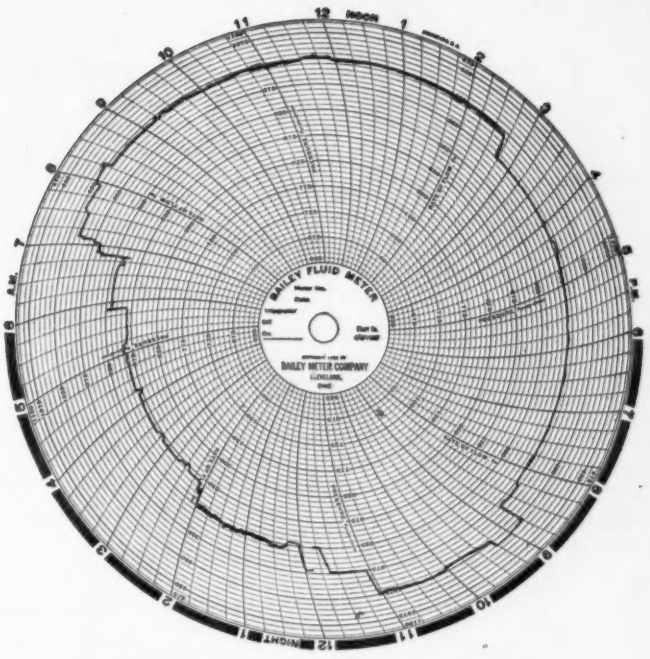
Why users *repeat* with COPES FLOWMATIC

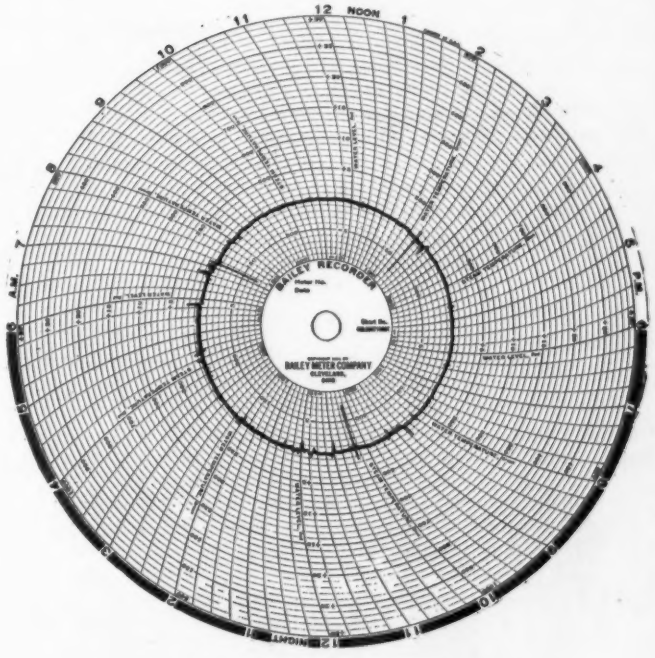
FOUR out of ten COPES Flowmatics in service today represent repeat orders from satisfied users. Highly flexible, the Flowmatic system permits easy adaptation to any piping conditions or operating preferences. Strikingly simple, the two-element COPES is easily kept at peak efficiency by the boiler operators. In most cases, not even initial start-up requires "expert" servicing. And control is dependably accurate year after year.

As a case in point, the charts at the right were recorded five years after the 875-psi, 875-F boiler was placed under Flowmatic control. There is a load range of from 250,000 to 410,000 pounds per hour, with water level held within limits of plus-or-minus one-half inch. Obtained with only routine attention from the operators, this close control has brought a repeat order for COPES Flowmatic for a duplicating boiler being erected.

A performance report on COPES Flowmatic in this and two other stations of the same utility system is given in Bulletin 469. Write for it.



Load range is 160,000 pounds per hour



Level is stabilized within ± ½-inch

NORTHERN EQUIPMENT COMPANY

871 GROVE DRIVE, ERIE, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France

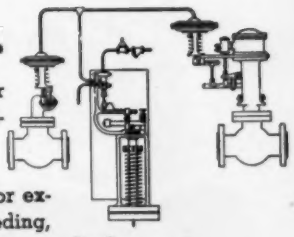
Representatives Everywhere

★ GET CLOSER LEVEL CONTROL WITH COPES FLOWMATIC

DESUPERHEATER...

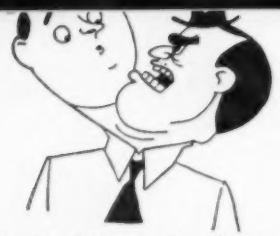
Here's a desuperheater every bit as effective on light loads as at full capacity. No water dribbles into the steam line. There is complete atomization of the cooling water from zero to full load because the opening of the spray nozzle—not the pressure drop across it—is varied with steam temperature. A self-contained unit, as *dependable* as the COPES Feed Water Regulator. Write for Bulletin 405-A.

MASTER CONTROL...



Remote control of reduced water or steam pressures, with single or multiple pressure reducing stations, is *dependably* accurate with the COPES Master Control. Adapted for excess pressure control in boiler feeding, where one or more turbine-driven pumps discharge into a common water header. Details on request.

'Let's Be Human'



"If you can learn to handle yourself, handling others is simple."

"Never miss an opportunity to tell him about his good work."

"Important . . . to keep their eyes on the objective. That's half the battle."

"It can't be done with mere force or logic. It's a waste of time to try."

"A good boss . . . is a good listener."

"Show them that you feel it is important that they know what's going on."

Let's Be Human is the title of one of the most unusual—and at the same time helpful—books we've ever come across. The subtitle is perhaps more descriptive—*Seven Steps to Increase Your Ability to Handle People,* published by Duell, Sloan & Pearce, 270 Madison Ave, New York 16, N. Y. ($2.50). John L Beckley is the author.

It's rather a thin little book—only 122 pages—and I don't suppose there are more than 500 words in the whole of it. Its beauty is its directness: a series of dramatic cartoons with one- or two-line captions summarizing the science of handling people better. The seven simple rules are:

1 *Perfect Your Self-Control.* This means control of your temper, avoid anger in front of your men, treat all men fairly and equally, don't make snap decisions that have to be reversed the next minute.

2 *Appreciate and Praise.* Consider everything about your men important: their jobs, their homes, their families, thoughts, emotions, ambitions. Let a good man use his ingenuity.

3 *Stress Rewards; Avoid Punishments.* Don't talk about penalties; keep stressing the rewards and advantages of doing the job well. Avoid petty discipline. Remember that men don't like to be treated like a bunch of children.

4 *Criticize Tactfully.* The surest way to earn a man's resentment is to bawl him out in front of others. Before you criticize what is bad, try to get results by praising what is good.

5 *Always Listen.* Everyone likes to express his opinion, especially to the boss himself. That's why a good boss is always a good listener. Before making a decision, give your men a chance to express their opinions.

6 *Explain Thoroughly.* The more you can make your men feel like full-fledged partners, the better they will work. Spike rumors with facts. Get your men so that they rely on you for accurate information.

7 *Consider Your Men's Interests as You Would Your Own.* When a man does a good job, go out of your way to see that he gets full credit. The best way to make people eager to work for you is to go to work for them.

These are the seven rules—the framework of a handbook that will cut a clean, concise path for you. We can recommend it to you unreservedly —it will pay you back many times over, and will aid you even in home relations. I know—I tried it.

George Edwards

Engineer

The RIGHT INSULATION, correctly applied, NEVER GROWS OLD

ENGINEERING: In planning your insulation job, first call in an experienced insulation engineer. Johns-Manville . . . Insulation Headquarters for more than 75 years . . . maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job . . . make it "*right* the *first* time."

RIGHT INSULATION: Any insulation will save money—but only the *right* one will save the most for the longest period of time. J-M 85% Magnesia is the most widely used of all industrial insulating materials . . . and one of a wide range of J-M insulations for every service and temperature.

CORRECT APPLICATION: No insulation is better than the man who installs it. J-M Insulation Applicators are industry's first choice for completely efficient jobs because: (1) They are trained in all phases of insulation application; (2) They employ skilled mechanics and up-to-date application methods. You can rely on them for thorough, dependable and speedy workmanship.

35 YEARS YOUNG! J-M 85% Magnesia was applied to pipes of the Eclipse Mill Company, Everett, Washington, back in 1912. Because this job was *engineered right* and *applied right,* it is still providing dependable insulation . . . still keeping fuel costs low. Get expert help with *your* insulation problem by writing to Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE *First in* INSULATIONS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

Alabama Underground Coal Gasification Results

▶ A RECENT EXPERIMENT in underground gasification of coal, conducted by Alabama Power Co and Bureau of Mines, demonstrated that such conversion is feasible for commercial production of power and possibly synthetic-liquid fuels. This conclusion was reached in June by representatives of power and mining industries and scientists, who were given results of the experiments at a meeting in Washington, D. C.

Although the experiment was conducted under adverse conditions, brought about by having relatively little roof over the burning seam of coal, the "make" gas produced ranged from 50 to 221 Btu's in calorific value. The light overburden resulted in loss of heat and pressure and in burnouts. A heavier cover over the subterranean gas producer, supplemented by an increased air blast, would make production of a 150 Btu gas a simple matter, according to specialists who conducted the experiment.

Power experts attending the meeting pointed out that a gas of 150 Btu content would be sufficient for operation of a nearby power plant of considerable size. Oil technologists also estimated that further research might develop an entirely new concept in production of synthetic-liquid fuels.

The next step, according to the consensus of those who heard the results of last winter's experiment (see POWER, March, p 144; April, p 172 and 176) should be a thorough study of the economic possibility of a commercial-size operation involving a sizeable tract of land containing enough coal to sustain production for 20 to 30 years. Upon the results of the economic study will hinge the decision on further development of underground gasification.

One of the experiment's principal troubles developed when the slate roof over the burning coal became plastic and flowed down over the fire, endangering air flow and flame control. "It cannot be definitely asserted that the manner in which roofs may fall, the extent

(*Continued on page* 174)

Underground Steam Mains 2900 Ft Down

Back in November 1939, POWER reported the harnessing of natural steam from a 100-square-mile area in the Tuscan hills of Italy to produce, by 1942, enough steam for the generation of 1,000,000,000 kwhr annually. Steam at 374F, 800 to 2900 ft underground, is led through pipes (12 to 28 in. diameter) up to the working level. There it either goes directly into the turbines or enters the closed cycle heat exchangers where it heats a pure water up to the steam point for the turbine driving force. Much of this war-interrupted energy source has been repaired and rebuilt with a total of 124,500 kw now operating

COMING EVENTS

Aug 17—New England States Assn of Power Engineers, meeting, Hotel Statler, Boston, Mass. Dudley G Kimball, chairman, 55 Clifton St, Dorchester 25, Mass.

Aug 25-28—National Assn of Power Engineers, meeting, Hotel Statler, Boston, Mass. A F Thompson, director of exhibits, 176 W Adams St, Chicago 3, Illinois.

Aug 26-29—American Institute of Electrical Engineers, Pacific general meeting, Hotel San Diego, San Diego, Calif. P M Klauber, 233 W Juniper St, San Diego 1, Calif.

Aug 28-Sept 13—Engineering & Marine Exhibition, Olympia, London, England. Kenneth W Bridges, K W Bridges & Sons, Ltd, Grand Bldgs, Trafalgar Sq, London W C 2, England.

Sept 2-9—Fuel Economy Conference, The Hague, Netherlands. H C Forbes, treasurer and secretary, Executive Committee of U.S. National Committee, World Power Conference, 4 Irving Pl, New York 3, N. Y.

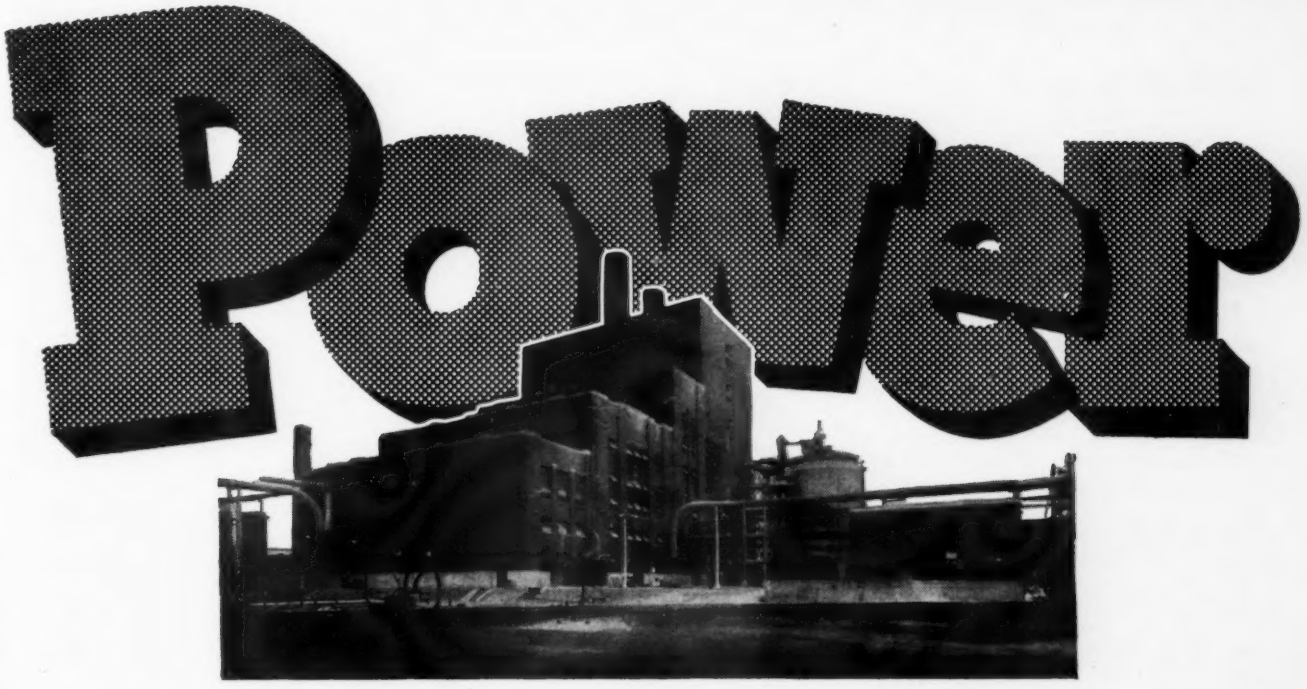
Sept 8-12—Instrument Society of America, second annual instrument conference and exhibit, Stevens Hotel, Chicago, Ill. Richard Rimbach, executive secretary, 1117 Wolfendale St, Pittsburgh 12, Pa.

Sept 22-25—Assn of Iron & Steel Engineers, meeting, Hotel Wm Penn, Pittsburgh, Pa. John B Harmon, exhibit mgr, Empire Bldg, Pittsburgh.

Sept 23-25—American Institute of Electrical Engineers, Middle Eastern district meeting, Biltmore Hotel, Dayton, Ohio. H H Henline, 33 W 39th St, New York 18, N. Y.

Oct 16-17—National Conference on Industrial Hydraulics, third annual meeting, Hotel Continental, Chicago. Dr V L Streeter, Armour Research Foundation, Technology Center, Chicago 16, Ill.

Oct 20-24—American Welding Society, annual meeting, Sherman Hotel, N Clark and W Randolph, Chicago, Ill. M M Kelly, secretary, 33 W 39th St, New York 18, N. Y.



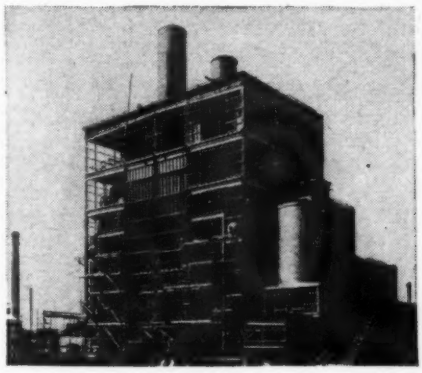
for Petroleum Refining

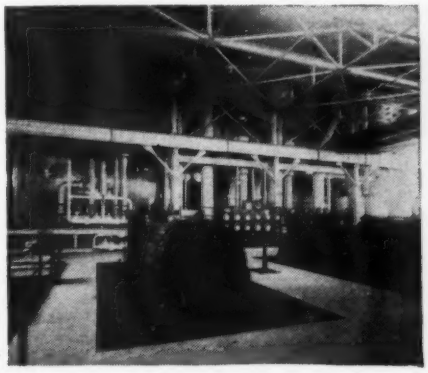
Great refineries of Standard Oil Company of Indiana convert the mid-continent's *black gold* into the myriad products and by-products which power and lubricate the planes, trains, ships, motor cars, production machinery in a large sector of industrial America.

But refineries, too, require power,—electricity, steam, compressed air, liquid pumping. At its huge Wood River, Illinois, refinery Standard Oil Company planned for present and future needs with a modern plant designed to provide all the power services for petroleum processing.

Dravo Corporation Power Plant Specialists accepted complete responsibility for construction of foundations, building, and equipment installation at Wood River; Standard Oil Company Construction Engineers were relieved of details of supervision, building trades coordination, integration of separate items of equipment.

Power and Boiler Plant Specialists at Dravo Corporation have a background of experience which can be of real value to industrial executives and consulting engineers concerned with construction and equipment installations for all types of power and boiler facilities. Further details of this Dravo experience are covered in Bulletin CF-504; Power Department, 300 Penn Avenue, Pittsburgh 22, Pa.





DRAVO CORPORATION

PITTSBURGH — PHILADELPHIA — CLEVELAND
NEW YORK — DETROIT — WASHINGTON
WILMINGTON

Power and Boiler Plants — Pumping Stations — Power Plant and Contractors' Equipment — Direct-Fired Heaters — Industrial Heating and Ventilating — Bridge Substructures — Docks — Pump Houses and Intakes — Mill Foundations — Locks and Dams — Shafts, Slopes and Tunnels — Towboats and Barges — Coal and Ore Bridges — Cranes and Derrick Boats — Crane Cab Coolers — Open Steel Flooring — Concrete Aggregates — Inland River Transportation

in receiving unit, it turns load off until the trouble has been corrected. This means that improperly operating units will not leave the load on during peak periods. **Dept P, Control Corp, 718 Central Ave, Minneapolis 14, Minn.**

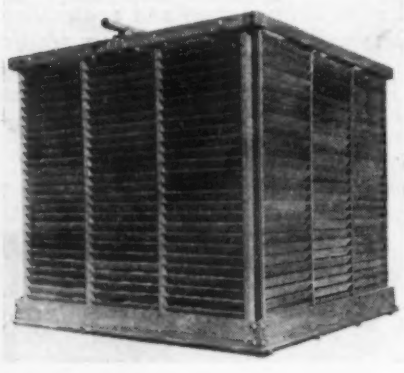
Vacuum Deaerator

LIQUON DEAERATOR consists essentially of chamber in which the water is broken up into thin sprays to permit release of dissolved gases from exposed water surface. A steam ejector or vacuum pump maintains the necessary vacuum corresponding to boiling point of the water at its comparatively low temperature.

In gas separating chamber water is first sprayed at top and then it trickles down over staggered noncorrodible trays or slats. **Dept P, Liquid Conditioning Corp, 114 E Price St, Linden, N. J.**

Masonry Drills

COMPLETE LINE of carbide-tipped masonry drills are put up in handy kits and box sets. Kits contain five of the most popular drill sizes and box sets contain eight. Both are available with drills having round or *Super Grip* hex-type shanks of improved slipproof design. **Dept P, Super Tool Co, 21650 Hoover Rd, Detroit 13, Mich.**



Cooling Tower

SERIES 200 spray-type natural-draft cooling tower comes in various sizes. It is designed in standard bays that permit increasing tower size if requirements demand. Sizes are from 65 to 1580 gpm. Heavy select heartwood lumber is used throughout, with galvanized bolts and special hardware at critical joints. Unit is designed for dairies, engine-jacket cooling, refrigeration in ice plants, air-conditioning, and diesel-engine cooling. **Dept P, Marley Co, Kansas City 15, Kan.**

Electric-Impact Tool

WITH STANDARD ATTACHMENTS, size 4*U* electric-impact tool applies and removes nuts. It also drills, reams and taps, drives and removes screws, drives and removes studs, extracts broken capscrews and studs, runs wire brushes, does hole saw work, drills brick and masonry, drives wood augers, etc. Machine weighs 6½ lb, has an over-all length of 10½ in., a free speed of 2000 rpm and delivers 1900 rotary impacts per min under load. It is powered with a specially designed reversible, universal, 3-amp motor that operates on 110-v ac-dc current.

When resistance to spindle rotation reaches a certain amount, a patented mechanism converts power of motor into "rotary impacts" that exert a powerful turning effect. An outstanding advantage of the impact mechanism, according to manufacturer, is that it permits spindle to be stalled completely while motor continues to run, thus eliminating motor burnouts caused by overloading. Impact mechanism also practically eliminates torque reaction to operator. There is no appreciable kick or twist under any condition, even when driving heavy taps or setting up capscrews. **Dept P, Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.**

Water Softener

IN THE NEW LIQUON ZEOLITE SOFTENER, special attention has been given to distribution of incoming water so it will not channel or short-circuit through the bed of zeolite during operation. Correct water distribution is provided by a special system over top of zeolite bed. A similar distribution system controls flow of outgoing backwash water and incoming brine that regenerates the zeolite.

An additional advantage of this cation exchanger is that it does not impart silica to the treated water. The apparatus produces water containing from zero to 2 ppm of hardness, expressed as calcium carbonate. **Dept P, Liquid Conditioning Corp, 114 E Price St, Linden, N. J.**

Terminal Strip

MULTIPLE WIRING to barrier terminal strips is greatly simplified through a fanning strip that is part of this unit. A cable of one to 20 wires can be securely anchored to proper terminals and quickly soldered. Connections to fanning strip can be made on a bench or anywhere apart from the mounted barrier strip, and the entire assembly slipped into place in the barrier in an instant. Only adjustment necessary at this point is tightening terminal screws. This speeds up assembly and saves time. Incorrect connections are eliminated in original assembly and during servicing. Correct and positive connections are assured at all times.

Brass terminals are cadmium plated and are securely riveted to a heavy *bakelite* mounting base. Number of terminals determines the length of the fanning strip. It is designed to serve with terminal strips No. 141 and 142. No. 141 provides 1 to 20 contacts, and No. 142 provides 1 to 17 contacts. **Dept P, Howard B. Jones Div, Cinch Mfg Corp, 2460 W George St, Chicago 18, Ill.**

Fluorescent Lamp

THIS NEW LAMP is not only more efficient, but emits a spectrum which predominates in light output in most sensitive portion of human eye. It is more efficient, says the manufacturer, than his daylight and white lamp. A considerable saving in power is possible with these lamps, a fact that tends to offset their higher initial cost. White objects, when viewed under this light, acquire a soft green pastel tint. **Dept P, Certified Electric Corp, Warren, Pa.**

Variable-Pitch Sheave

SUITED TO VERTICAL or horizontal shaft mountings, variable-pitch sheave maintains constant center line to permit use with V-groove companion sheave. It is for appli-

(*Continued on page* 160)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P.

First Steps . . .

MARK DISCOVERY Like an explorer inching his way into unknown lands, the early Dearborn chemist penetrated the realm of research. His objective . . . to track troublesome water characteristics to their source; to end scale deposits, foam, and corrosion difficulties.

Analysis of a sample of scale deposit was the first step. The water analysis and treatment formulation followed. Water troubles could then be prevented by scientific analysis and chemical treatment.

Subsequent Steps

ACHIEVEMENT New discoveries stir the pulse and imagination. Time verifies their merit. Today, marking our 60th Anniversary, Dearborn Water Treatment and Service are a vast enterprise . . . devoted to the prevention of water troubles the world over. Footsteps can be far reaching . . . they can lead, as they do here, to clean steam . . . long, trouble-free boiler life for industry . . . everywhere.

Dearborn Service Today!

OFFERS YOU THE ULTIMATE IN BOILER WATER TREATMENT

ESTABLISHED IN '97

EXPLORING NEW HORIZONS IN '57

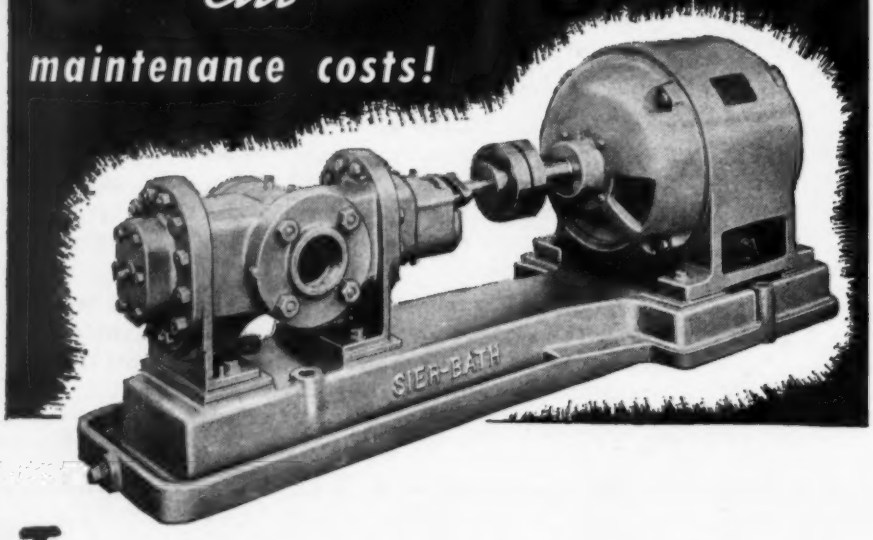
Dearborn

TRADE MARK REGISTERED

"THE LEADER FOR 60 YEARS"
ENGINEERING SERVICE AND WATER TREATMENT

Dearborn Chemical Company
Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

SCREW PUMPS built to SIER-BATH accuracy *cut* *maintenance costs!*



The high quality of design and construction of Sier-Bath Screw Pumps enables them to operate continuously for long periods without maintenance. The pulseless flow and vibrationless operation of these pumps greatly reduce maintenance cost—there is less wear on valves, couplings and other fittings. Pipes and joints remain tight and require little attention. With maintenance labor costs at an all-time high, these are important points to consider today in the selection of pumps.

Made in an up-to-date machine shop, accustomed to precision methods and equipped with the most modern machinery, Sier-Bath Screw Pumps always measure up to the highest standards required by users. They are made in both horizontal and vertical models.

Sier-Bath customers are protected from mis-application by the mature pump engineering experience of this Company's staff. Send for descriptive booklet.

ADVANTAGES:
● pulseless flow ● anti-friction bearings ● vibrationless operation
● low maintenance cost ● rugged construction

PUMPS: Acetate, asphalts, brines, Bunker C Fuel Oil, Cellulosics, Greases, Molasses, Syrups, Lube Oils, etc.

FOUNDED 1905 MEMBER A.G.M.A.

★ ALSO MAKERS OF SIER-BATH PRECISION GEARS

Sier-Bath GEAR and PUMP CO., Inc.

9254 HUDSON BLVD. NORTH BERGEN, N. J.

Byproduct Steam

(*Continued from page 67*)

bulence in the furnace and an intimate mixing of fuel and air for high rates of combustion.

Primary air, preheated with steam to 300 F, enters the furnace at right angles to the fuel just below the spray nozzles. This air is sufficient to develop maximum heat in the drying zone. As the drying and combustion processes are completed in the furnace, part of the inert chemicals drop to the bottom while the rest are carried up into the boiler passes. Part of this forms slag on the upper part of the tubes. Ample provisions are made in the boiler for hand lancing to remove this slag, which falls to the furnace bottom.

Recovery of Solids. Inert chemical dust carried by the gas stream lodges on the tubes and baffles in the second and third passes. In this boiler the tubes are blown continuously by a Diamond Specialty 25-head automatic soot blower using 300-psi air. One head after another blows and closes until the cycle of 25 heads is completed, then it repeats. Part of the solids blown from the tubes fall to an ash hopper below the third pass and to the ash-dissolving tank. Here a motor-driven agitator dissolves the chemical content in weak black liquor, which is used to control the concentration in the cascade evaporator.

About 90% of the solids that escape from the boiler and that are not picked up in the cascade evaporator are reclaimed in a Western electrostatic precipitator, installed in a building outside the recovery-unit room. In this unit solids in the gas collect on about 18 miles of electrodes, to which 60,000-v dc is applied. An automatic-air-operated tapper strikes the electrodes about every 15 min, causing the solids on them to drop to conveyors for removal and return to the chemical-recovery system.

Return of Recovered Solids. The unit is so operated that all chemicals in the recovery system are returned to the bottom of the furnace for refining. Refining is done by burning out the impurities with preheated air admitted to the furnace through nozzles near its bottom. Temperature in this zone is sufficiently high at all times to keep the smelt molten. During refining, the smelt flows continuously into the main dissolving tank, as slag flows from a continuous slag-tap pulverized-coal fired furnace. In this tank, smelt is dissolved with water by a motor-driven

Fittings Are Scarce!

save seven per trap with SUPER-SILVERTOPS

Although the situation is not quite as extreme as the scene above, fittings *are* scarce. That's one more reason for using Super-Silvertop Steam Traps and their simplified piping. You save as many as nine fittings per trap installed, when you use Super-Silvertops—not only in the smaller sizes, but in the big ones and in the higher pressure traps as well.

Super-Silvertops give you the choice of elbow or straight-in-line piping (only one nipple needed, either way) and there are no split gaskets or cored passages used in the design. Investigate the savings in fittings and labor—send for details fully described in the free book "How To Choose A Steam Trap." Write today for your copy.

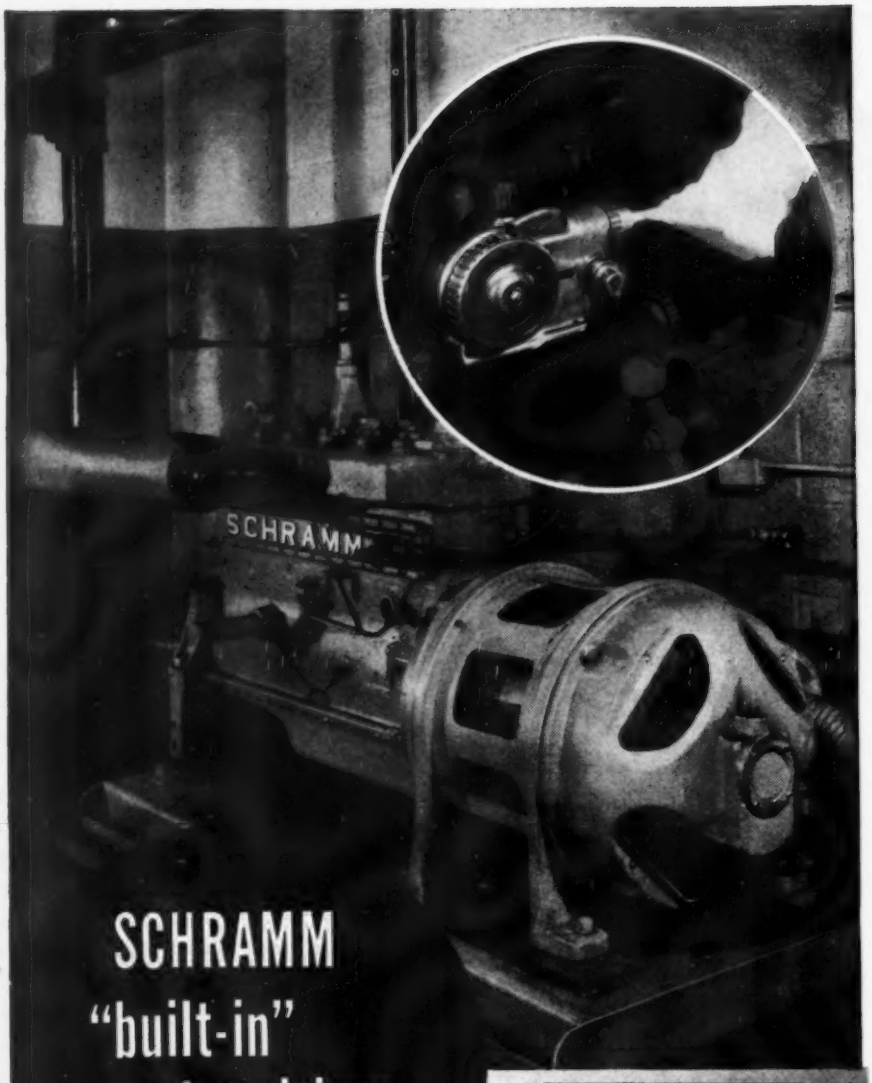
THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • CLEVELAND 2, OHIO

and here's how

Super-Silvertop showing one nipple and one union needed.

Conventional trap using seven fittings and two unions.

SUPER-SILVERTOP
STEAM TRAPS



SCHRAMM
"built-in"
motor driven
compressor

Schramm #210 stationary compressor operating metallizing gun and other pneumatic tools in the plant of the Metallizing Engineering Company, Long Island City, New York.

Reclaiming defective castings . . . a process developed to enable foundries and machine shops to effect a positive repair of defective aluminum castings. May also be used for reclaiming bronze, grey iron, malleable iron, as well as steel castings.

This is only one of the hundreds of different applications of compressed air for industrial and manufacturing plants as furnished by the Schramm heavy-duty, continuous service, built-in motor or "V" belt drive compressors ranging from 2½ to 600 cu. ft. displacement.

Write for catalog 45A.

SCHRAMM INC.
THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

tator to form [illegible] for the causticizing plant before conversion to white liquor for wood cooking in the digesters.

Recovery unit has three main functions: (1) recovery of chemicals from the spent cooking liquor (2) refining of these chemicals for return to process (3) production of steam for process, drying and heating. Even though the latter is a secondary object in the recovery unit's operation it is important.

At full capacity the unit, Fig. 5, produces 106,000 lb of steam per hour and has operated at 120,000 lb. Of this amount, about 40.000 lb are required in the multiple-effect evaporators, the air heater and for atomizing the black liquor in the fuel nozzles.

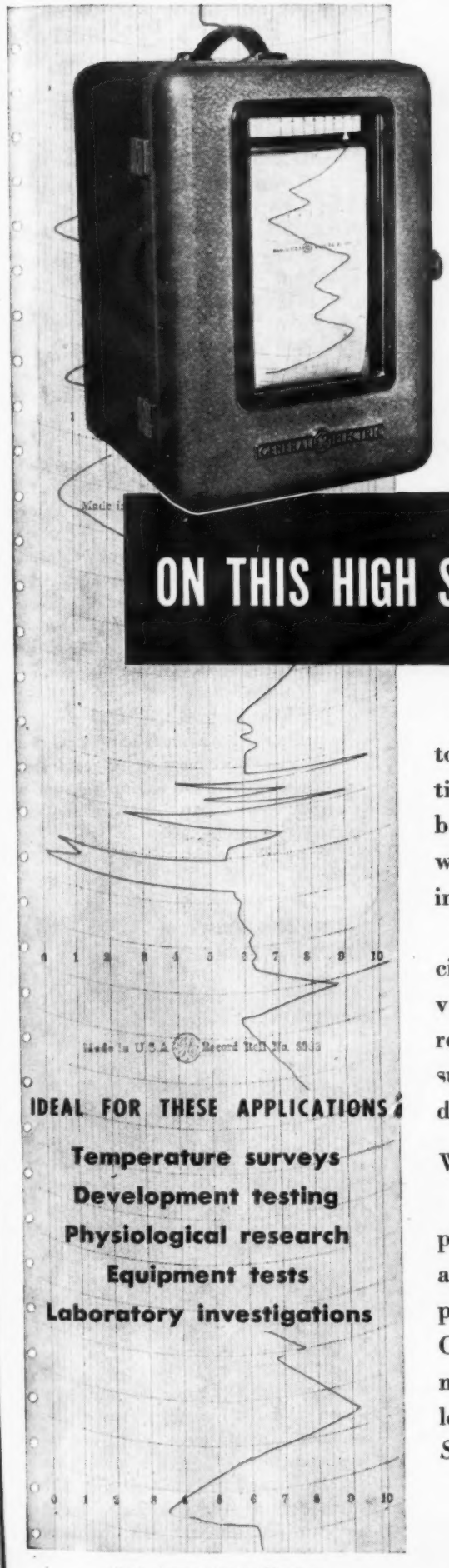
Operation of the unit is in general under hand control, the operators being provided with meters to show performance in every part of the system.

Coal-Fired Boilers. All steam, not supplied by the electric and bark-burning boilers and the chemical-recovery unit, is obtained from three coal-fired units. Two of the old boilers, previously mentioned, were reinstalled in modern settings and coal-fired by underfeed stokers. These boilers are rated 10,000 lb of steam per hour at 175 psi saturated. They serve as standby units and take peak loads when the new pulverized-coal fired boiler is not required. This unit, with 11.280 sq ft of heating surface, is rated 100,000 lb of steam per hour at 450 F.

In summer, these coal-fired boilers supply about 10% of total steam for all operations, and in winter about 40%. The remainder comes from the byproduct units. This steam, produced by burning very little coal or oil, represents a large annual fuel saving. For the bark-burning boilers and chemical-recovery unit, coal saving is only part of the economic story. Burning the bark to produce steam solves what would otherwise be a serious and expensive disposal problem. Recovery of expensive chemicals in the chemical-recovery unit is one of the chief factors that justifies its operation economically.

POWER *expresses appreciation to the following: R A Hayward, president and general manager, Kalamazoo Vegetable Parchment Co, for permission to write this article; S L Foster, chief engineer, R E Simkins, resident engineer, and F D Beaudry, steam-plant engineer, for the data from which it was written.*

General Electric Co is installing equipment for manufacture of plastic molded parts in a newly purchased factory at Decatur, Ill. The plant was purchased from the War Assets Administration.



If you can MEASURE it
You can RECORD it

ON THIS HIGH SPEED PHOTOELECTRIC RECORDER

Extreme sensitivity enables this G-E photoelectric recorder to produce permanent records of the smallest electrical quantities. High-speed response is made possible by a photoelectric balancing system which assures that the recording mechanism will follow each minute change in the deflection of the measuring element.

Since measurements frequently must be made on electric circuits in which output power is not sufficient to actuate conventional recorders, a highly sensitive instrument with fast response time is required. The photoelectric recorder is ideally suited for providing accurate chart records under these conditions.

IDEAL FOR THESE APPLICATIONS

Temperature surveys
Development testing
Physiological research
Equipment tests
Laboratory investigations

Width of actual chart is 4⅜ inches

WIDE ADAPTABILITY PERMITS VARIETY OF USES

By employing interchangeable basic-element assemblies, the photoelectric recorder can be adapted to a variety of uses. In addition, photoelectric recorders are available as self-balancing potentiometers, with as many as 11 self-contained ranges. Chart speeds ranging from ½-inch per hour to 72-inches per minute are available. For further information, write for Bulletin GEA-2394. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

660-109

THERE is a wealth of practical, up-to-date factual information about expansion joints and flexible connectors packed into this *new* 60-page catalog compiled by the technical staff of Zallea Brothers & Johnson.

For instance, twenty double-pages offer specific, usable data on the many types of Zallea expansion joints. There's a full description of the manufacturing process for every expansion joint that includes welding and forming, annealing, pickling and passivating.

In addition you'll find detailed discussions on how to select the proper expansion joint for each specific application and the advantages of each, *plus* many charts and diagrams. Also, it's profusely illustrated with photographs of actual applications.

Never before has such a complete, comprehensive catalog been published on expansion joints and flexible connectors *exclusively.* Catalog 47 is *FREE* . . . a request on your company letterhead will bring it to you. Use it as a guide or as a permanent reference source. And when unusual conditions confront you, ask for the assistance of our technical specialists. *Zallea Brothers & Johnson, 814 Locust Street, Wilmington 99, Del.*

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Reader's Problems

(*Continued from page* 113)

I assume the turbine is not coupled to the generator during this run, but if it is, extreme care should be taken not to damage the parts by internal heating. The turbine manufacturer should be consulted for recommendations concerning amount of ventilating steam required and other precautions.

Ordinarily it is not difficult to motorize one generator from another, but *ALD's* problem is complicated by four factors: (1) The machine that is to be motored has a larger kva rating than the driving machine. (2) The transformer bank between the machines causes a reactance in the system. (3) It is difficult to start a steam engine smoothly without a jerk. (4) The two machines have different types of prime movers and, therefore, have different speed characteristics. A small increase in speed of the engine set causes a large increase in the speed of the turbine set because of the larger number of poles on the low-speed machine.

I will be surprised if *ALD* synchronizes the machines on the first trial, but with some experimenting to get proper field strength of the engine set, and a smooth, slow start, the turbine-generator can be motorized.

Swampscott, Mass. M G MOORE

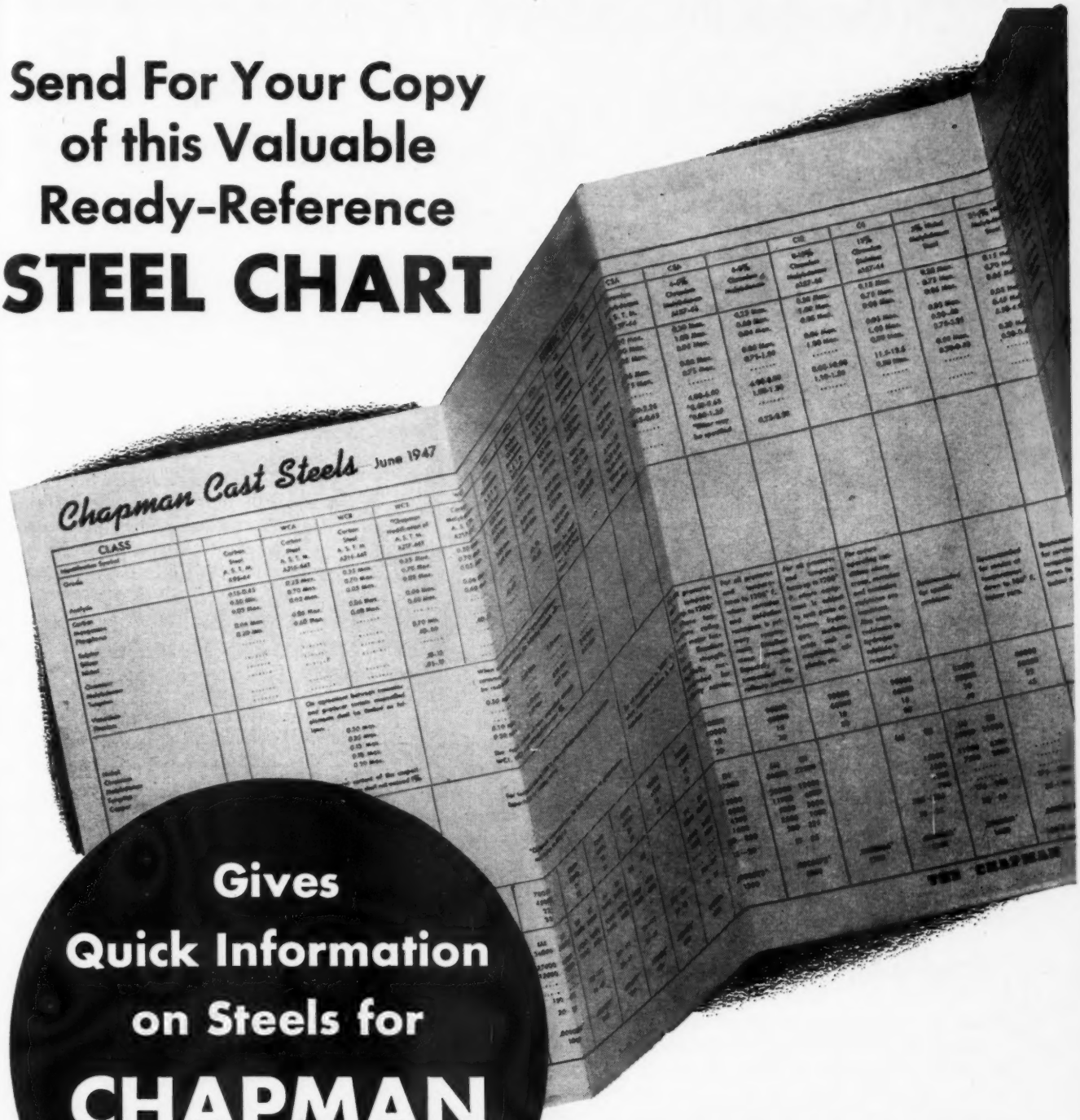
Run the Engine At Low Speed

IT IS QUITE POSSIBLE that *ALD* can run the 1000-kva turbine-generator from the 750-kw engine-driven generator set, but a number of starting tests may be required.

Generator and turbine should be uncoupled to run the generator as a motor. This reduces the starting load on the engine. If the unit cannot be uncoupled. the turbine should not be run more than ten minutes during the test or the casing will become overheated. Also, if oil pumps are used to supply the bearing lubrication, they must be started as part of any starting sequence.

If the turbine cannot be uncoupled, I suggest *ALD* bring the unit up to speed and synchronize through the common transformer bus with the engine-driven set. If the turbine and generator are disconnected, and if the engine-driven generator main field is not provided with separate excitation, it is hopeless to start the turbine-driven

Send For Your Copy of this Valuable Ready-Reference STEEL CHART



Gives Quick Information on Steels for CHAPMAN Valves

Chapman Steel Valves are available in a wide diversity of compositions to meet every service requirement. The valuable reference chart shown above (reduced in size) tabulates these various types of steels, enumerating the grade, analysis, alloys, applications, and physical properties of each.

Users of steel valves have found this chart to be a handy reference guide. Due to the many requests which Chapman has received for this chart, we have printed a special edition. Chapman now makes the chart available to you. Write today for your copy.

THE CHAPMAN VALVE MANUFACTURING CO.
INDIAN ORCHARD, MASSACHUSETTS

On the spot for supplies?

Get'em fast by Air Express

You get supplies and equipment the fastest possible way when you specify Air Express. This speedy service makes hay out of shipping time—delivers you what's needed in hours instead of days.

Your shipment travels at speeds up to five miles a minute by Air Express. Because Air Express goes on all flights of all Scheduled Airlines, no time is lost waiting for loads to accumulate. Regular use of Air Express keeps your business running in high gear — helps give customers better service. Frequent flights to and from points overseas make foreign shipping problems simple, too.

Specify Air Express-it's Good Business

- Low rates — special pick-up and delivery in principal U.S. towns and cities at no extra cost. • Moves on all flights of all Scheduled Airlines.
- Air-rail between 22,000 off-airline offices.
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Just phone your local Air Express Division, Railway Express Agency, for fast shipping action . . . Write today for Schedule of Domestic and International Rates. Address Air Express, 230 Park Ave., New York 17. Or ask for it at any Airline or Railway Express Office. Air Express Division, Railway Express Agency, representing the Airlines of the U.S.

AIR EXPRESS

AIR EXPRESS

GETS THERE FIRST

Fastest delivery—at low rates

Engine parts (36 lbs.) picked up at Portland, Ore., factory late on 10th. Delivered to Los Angeles consignee 821 miles away, 9 AM on 11th *in time*. Air Express charge — **$8.84!** Other weights, any distance, similarly inexpensive and *fast!*

1927— 20TH YEAR OF GETTING THERE FIRST! — 1947

generator by the method described below.

Start the engine-driven generator and bring it up to about 70 rpm. The turbine-generator field should be open. Close the main switch, tying the two generators together through the transformer and bus. Adjust the engine to hold about 70 rpm, and energize the field of the 750-kw engine-driven generator with minimum field current. As *ALD* strengthens the field current, the turbine-generator should break away and accelerate. If it doesn't start within 30 seconds, open the main supply switch. If it accelerates slowly, increase the 750-kw engine-driven generator to full speed. Lower the generator field current, if necessary, to avoid excessive current.

When the engine-driven generator reaches full speed, close the field at about half strength on the 1000-kva unit. The turbine-generator can now be adjusted for normal speed and the vibration checked.

Tenafly, N. J. K B HOFFMAN

Use Small Motor to Start Big Generator

I HAVE TRIED connecting two generators, bringing them up to speed together, but it is a hard thing to do. The magnetizing current, and consequent low power factor, scares a man who does not want to burn out a generator. It can be done, but I recommend that *ALD* bring his 1000-kva generator up to speed, with a motor or engine, and synchronize it just as he does when he puts it on the line. Be sure to run it in the same direction. Rigging things up will cause some trouble and labor, but it will save time and danger in the long run. He can try bringing the two units up to speed together. But he mustn't hold them together too long if they don't want to start, or a coil will let go.

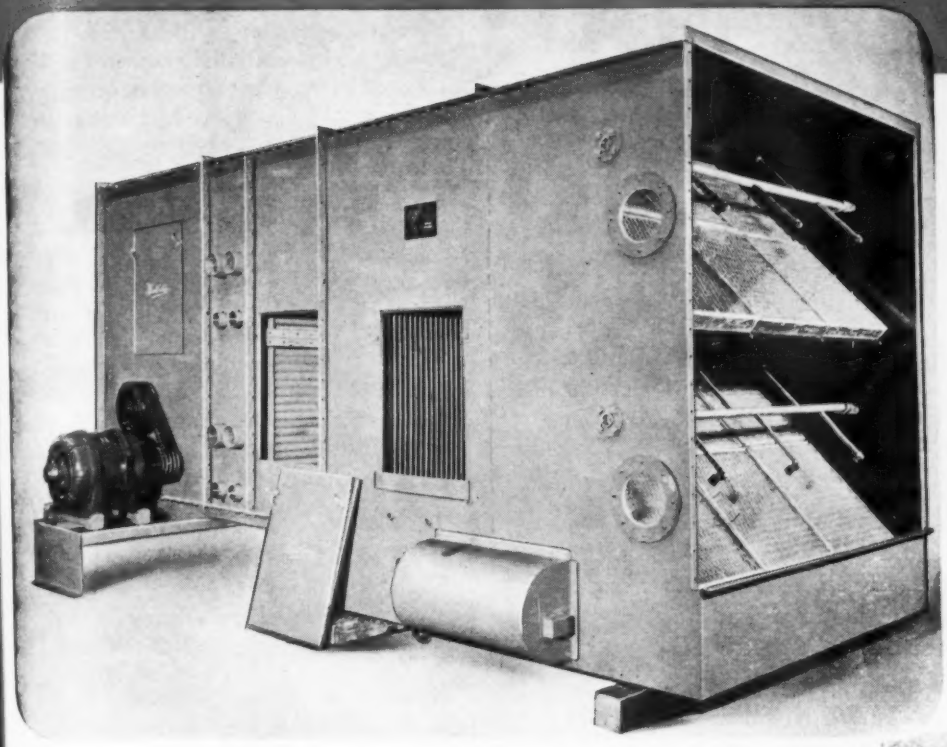
Carlsbad, New Mex. E A ROBERTS

Small Generator Not Big Enough

I ASSUME that *ALD's* electrical connections are correct. It seems obvious that, when the circuit was closed between the two units, output of the smaller generator was not enough to overcome the friction of the 1000-kva rotor and start it turning.

If possible, apply some external means to start the 1000-kva rotor. Turn or bring it up to synchronous speed before closing the circuit between the two machines. If this were done, I

CLEAN AIR with HUMIDITY and TEMPERATURE CONTROL at MODERATE COST!



● "Buffalo" Wet Glass Cell Air Washer, showing spray banks and filter packs at front.

● Here's triple-process air conditioning for product quality control as well as health, comfort and efficiency in your personnel!

"Buffalo" Wet Glass Cell Air Washers do this to your air:

(1) Remove 98.5% of the visible dust dirt other air-borne impurities.

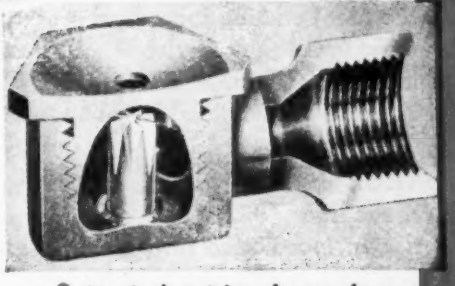
(2) Humidify your air to the exact degree you require — and hold humidity at that point.

(3) Heat to desired temperature, by efficient heating coils through which air passes.

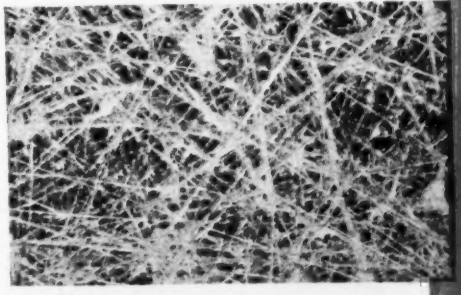
(4) Cool—by means of chilled water, in sprays or by means of cooling coils.

—at moderate cost! "Buffalo" Wet Glass Cell Air Washers are not difficult to install, and fan and pump power requirements are low.

WRITE FOR BULLETIN 3457. **It gives you facts to help you choose the most economical, effective unit for your particular need.**



● Atomized curtains of spray from improved "Buffalo" nozzles such as the above, "bathe" the passing air constantly and thoroughly.



● The "heart" of a "Buffalo" Wet Glass Cell air cleaning process is this fine, closely intermeshed glass fibre which "scrubs" off the dirt as the air passes through.

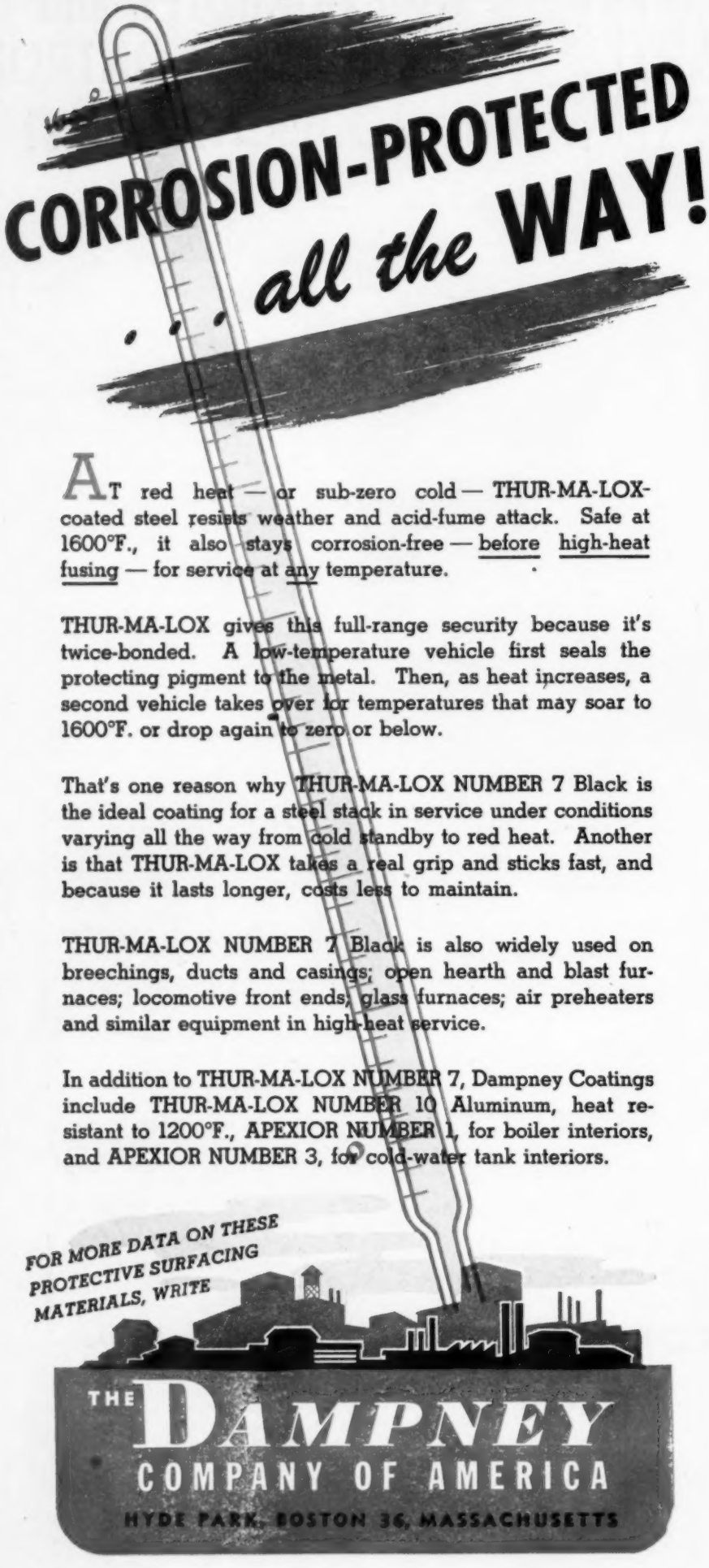
BUFFALO FORGE COMPANY

488 BROADWAY **BUFFALO, N. Y.**

Canadian Blower & Forge Co., Ltd., **Kitchener, Ont.**

"Buffalo"

WET GLASS CELL AIR WASHERS


CORROSION-PROTECTED
. . . all the WAY!
AT red heat — or sub-zero cold — THUR-MA-LOX-coated steel resists weather and acid-fume attack. Safe at 1600°F., it also stays corrosion-free — before high-heat fusing — for service at any temperature.
THUR-MA-LOX gives this full-range security because it's twice-bonded. A low-temperature vehicle first seals the protecting pigment to the metal. Then, as heat increases, a second vehicle takes over for temperatures that may soar to 1600°F. or drop again to zero or below.
That's one reason why THUR-MA-LOX NUMBER 7 Black is the ideal coating for a steel stack in service under conditions varying all the way from cold standby to red heat. Another is that THUR-MA-LOX takes a real grip and sticks fast, and because it lasts longer, costs less to maintain.
THUR-MA-LOX NUMBER 7 Black is also widely used on breechings, ducts and casings; open hearth and blast furnaces; locomotive front ends; glass furnaces; air preheaters and similar equipment in high-heat service.
In addition to THUR-MA-LOX NUMBER 7, Dampney Coatings include THUR-MA-LOX NUMBER 10 Aluminum, heat resistant to 1200°F., APEXIOR NUMBER 1, for boiler interiors, and APEXIOR NUMBER 3, for cold-water tank interiors.
FOR MORE DATA ON THESE PROTECTIVE SURFACING MATERIALS, WRITE
THE DAMPNEY COMPANY OF AMERICA
HYDE PARK, BOSTON 36, MASSACHUSETTS

believe that the difficulty would be overcome. The turbine of the units might possibly be utilized to do this.

Rockland, Me. ERIK KLOKHOLM

Belt a Small Motor To the Generator

I BELIEVE *ALD's* plans for starting his 1000-kva generator will have to be modified. Evidently the alternator will not start as an induction motor, because it is not equipped with a squirrel-cage winding. This is necessary in all self-starting synchronous motors.

I think the only successful way of getting this generator up to synchronous speed is to use its turbine or some other source of power. If the bolts in the coupling between the turbine and generator are removed, an induction motor can be belted to the generator side of the coupling.

The pulley diameter on the induction motor should be such that when the latter is running at full speed, the generator will be slightly above synchronous speed. The switch on the starting motor could then be opened and the generator allowed to coast down to synchronous speed, paralleling it with the engine-driven generator. Excitation on generator fields should be handled the same, as though both machines were generating in parallel.

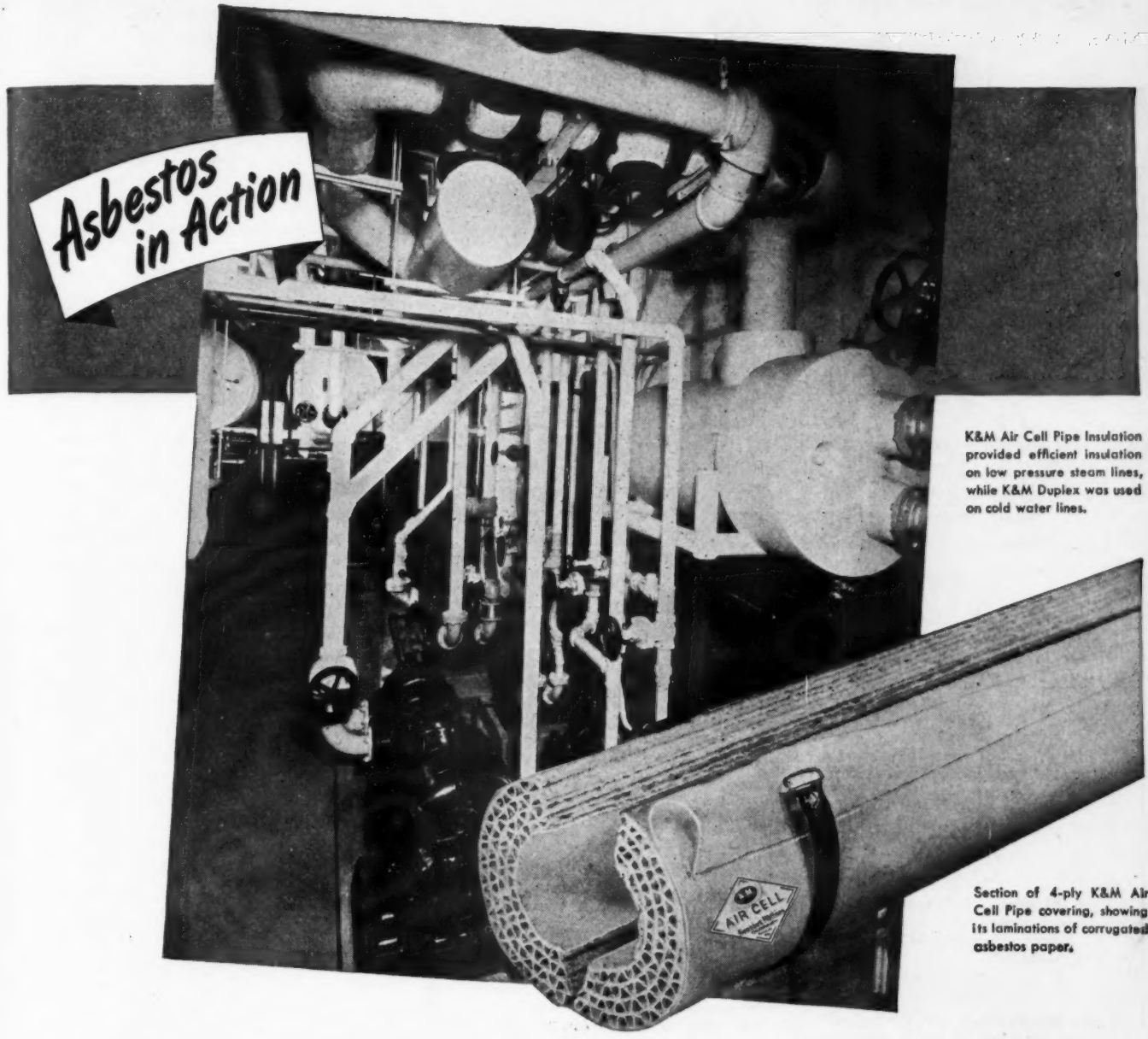
Horsepower of the starting motor is, of course, dependent upon the friction and windage of the alternator field and bearings. This would have to be determined by experiment.

Duluth, Minn. E. R. WEBBER

External Resistor Gives Greater Torque

AS ALD HAS FOUND OUT, the starting current with full voltage impressed may be six or seven times the full load current when throwing the 1000-kva generator across the line. Torque output of the motor varies as the square of the impressed voltage. Therefore with exceedingly low voltage, the torque may not be sufficient to overcome the inertia of the machine and start rotation of the shaft. Since starting current varies almost directly with the impressed voltage, the current may be reduced by lowering the voltage. Remember the effect on the torque when doing so.

When starting a synchronous machine as an induction motor, voltage induced in the dc field may be high enough to break down or puncture the insulation. To guard against this, the winding should be sectionalized so the voltage in any section will be within limits.



K&M Air Cell Pipe Insulation provided efficient insulation on low pressure steam lines, while K&M Duplex was used on cold water lines.

Section of 4-ply K&M Air Cell Pipe covering, showing its laminations of corrugated asbestos paper.

For efficient low pressure insulation

K&M AIR CELL PIPE INSULATION

Nature made Asbestos
Keasbey & Mattison has made it serve mankind since 1873.

K&M best in asbestos

Reg. U. S. Pat. Off.

The engineer for this Texas commercial building made a wise choice when he specified K&M Air Cell Pipe covering for the steam lines. He got an asbestos insulating material of exceptional efficiency on lines carrying up to 300°. He also got an economical installation . . . for K&M Air Cell's extreme light weight and split construction makes for easier application.

As a finish over the block insulation on the boilers, he chose K&M Asbestos Insulating Cement. This cement combines maximum insulating efficiency with maximum covering capacity.

If you have a low pressure insulation problem, why not let our engineers tackle the job for you? Their training and experience are backed by a complete line of K&M insulating materials for every industrial need. And K&M has expert application contractors, located strategically throughout the country, to assure you of a high quality job. Write us—we'll attend to your inquiries promptly.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
IN CANADA — ATLAS ASBESTOS COMPANY., LTD. • MONTREAL, TORONTO, WINNIPEG and VANCOUVER

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

IDENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE

Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO

High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Vgn. Ry.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

CHARMCO

Unexcelled Steaming Coal from the Fire Creek Seam in Greenbrier County, W.Va., originating on the N.F.&G.R.R.

ANTHRACITE — Hazle Brook Premium . . . Raven Run

General Coal Company

123 SOUTH BROAD STREET, PHILADELPHIA 9, PA.

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI NEW YORK NORFOLK PITTSBURGH

similar to the sectionalizing switch of a synchronous converter. By proper adjustment of an external rotor resistance, the starting power factor may be relatively high, 85 to 90%; the starting current is held about equal to full-load value. The usual method of starting an induction motor requires some means of reducing the voltage, usually a compensator, although a series resistance can be used.

I offer three solutions which may allow *ALD* to start and run his 1000-kva machine separately from the prime mover:

1. With the engine generator set running, adjust the field current to give a leading power factor. Insert external resistance in the rotor circuit of the turbine-generator. Apply a reduced voltage on the machine by means of a compensator, and allow it to come up to speed slowly. A series condenser can be connected in the line to give a "stiffening" effect and to improve the power factor.

2. Use a small motor, connected with a clutch to the 1000-kva machine, to get it running at synchronous speed before it is thrown across the line. Disengage the clutch after the machine is synchronized.

3. Start the engine-generator set with the power line to the 1000-kva machine open. Set the field current on the 750-kw machine at a minimum, and its terminal voltage will also be at a minimum. Connect the two machines electrically and slowly increase the field current to increase the voltage of the line. This last method is a gamble. It may or may not allow the larger machine to run as a motor, but it can be tried with no extra equipment.

Somerville, Mass. J P HOAR

Use Transformer As Starter Unit

BECAUSE OF THE HIGH TORQUE, I can see why the circuit breaker jumped out when *ALD* tried to start the 1000-kva alternator as a motor. He may be able to apply the mechanical energy of the turbine to bring alternator up to speed. Then he can synchronize both units, and throttle the steam of the turbine to a negligible value. The turbine probably requires some steam when running idle. Check with manufacturer.

If the turbine is out of operation or no steam is applicable, *ALD* should start the turbine set as a synchronous motor to minimize line disturbance. He can accomplish this by reducing the voltage to the turbine alternator with either a resistor or tap-changing transformer. Or he can connect stator star

Automatically

• • • cut in a boiler

• • • isolate a boiler

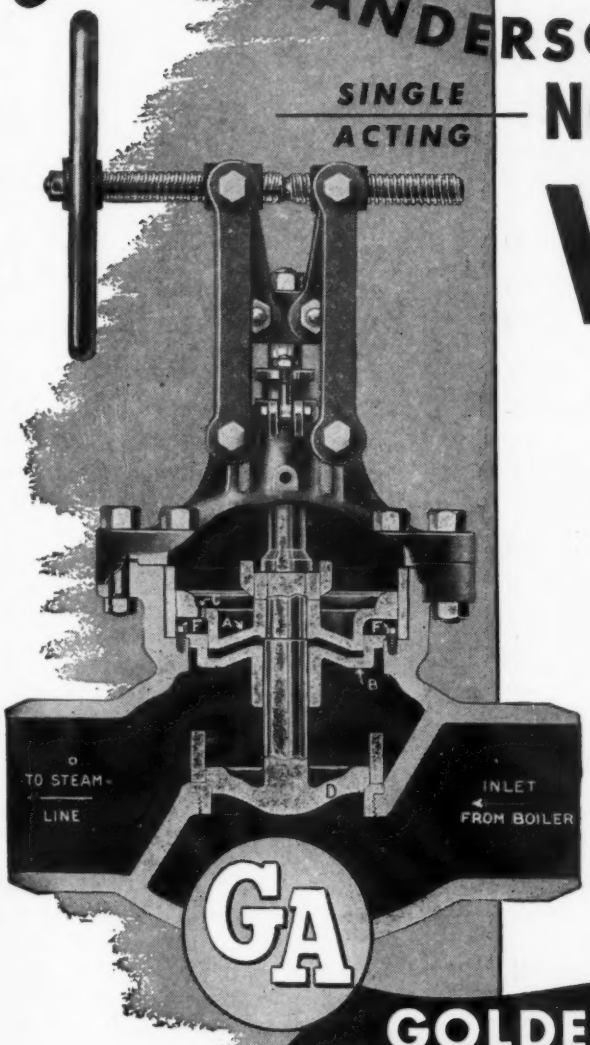
For absolute, dependable safety—choose GOLDEN-ANDERSON Non-Return Valves—they will automatically isolate a damaged boiler against reverse steam flow as well as closing down steaming boilers due to ruptured steam line or header beyond the valves.

GOLDEN-ANDERSON

SINGLE ACTING

NON-RETURN

VALVES



Available in series 600, 900, and 1500. Regular sizes from 2½ inch to 14 inch in Angle, Globe and Elbow Patterns; Special Sizes and Cross Pattern also available. Valves may be piped to any convenient boiler room station and by exhausting pressure from annular space between valve dashpots cause valve to close and thus prove it operative and reliable for any emergency operation.

Engineering Aid

For any problem involving high or low pressure, to meet practically any service requirement—call on GOLDEN-ANDERSON engineers.

GOLDEN-ANDERSON

VALVE Specialty Company

KEENAN BUILDING · PITTSBURGH 22, PA.

Other GOLDEN-ANDERSON Automatic **VALVES**

- Emergency Trip Valves
- Altitude Control Valves
- Pressure Reducing Valves
- Coke Quenching Valves
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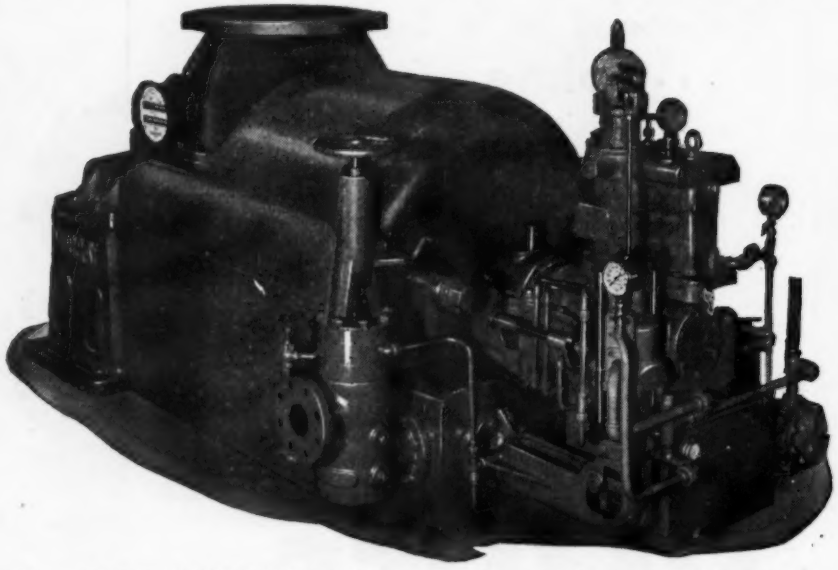
- Over 1500 Types and Sizes for Safe, Dependable Flow Control



One of two MURRAY multistage steam turbines, designed to deliver 685 horsepower on steam at 110 pounds and exhausting to 26½ inches Hg vacuum, furnished to drive high speed centrifugal compressors for refrigeration in one of the most prominent Southern Hotels. A third unit has recently been shipped. Equipment includes variable speed oil relay governor, trip and throttle valve, strainer surrounding the double seated balanced governor valve, and force feed lubrication.

MURRAY

MULTISTAGE STEAM TURBINES

★ ★ ★ ★

The complete MURRAY line of steam turbines includes all variations of mechanical drives, and turbine generator sets up to and including 3000 KW rating.

Sales Representatives for Murray products are located in all principal cities.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

for starting and quickly change to delta for running. He may use the existing transformer either by tap changing or delta-star connection, or a combination of both.

Astoria, N. Y. CARL BACHMANN

Start Generator With Its Turbine

IF ALD has the plant arranged so the two machines can operate in parallel, the requirements are simple. Have both machines running together; then shut off the steam to the turbine, and the alternator will continue in step as a synchronous motor. The voltage will step up through the transformers. If the machines aren't arranged to operate in parallel, it will be necessary to phase them out, and arrange synchronizing lamps.

Dallas, Texas F A BUTLER

ASME Meeting

(*Continued from page 94*)

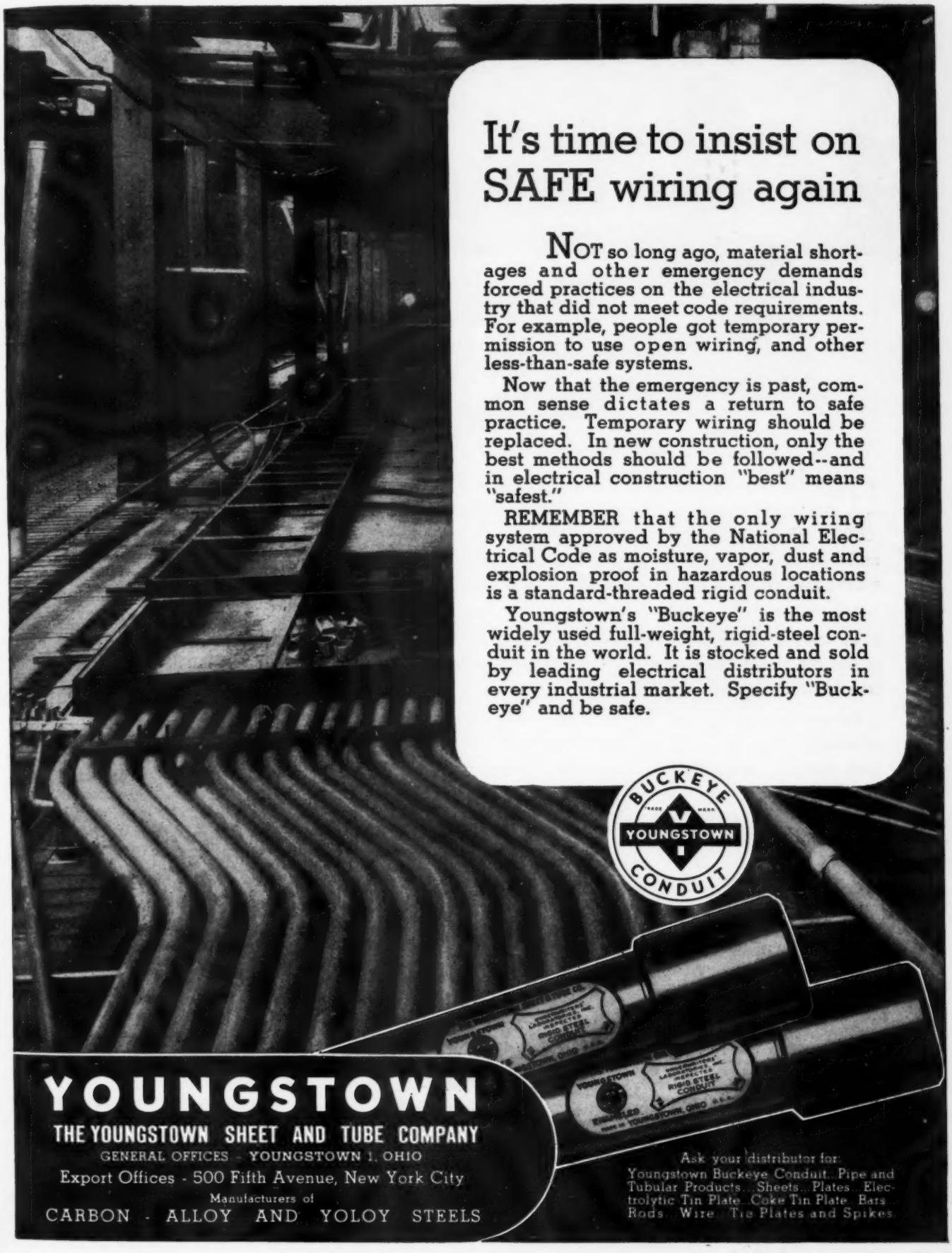
Action of Inhibited Hydrochloric Acid on Boiler Tubes, *by J L Wasco and F N Alquist, Dow Chemical Co, Midland, Mich.* The effect of inhibited hydrochloric acid solutions on boiler tubes of various specifications is presented. Tests were made at 140, 160 and 180 F, using three inhibitors and four concentrations of hydrochloric acid solution. Graphs show effect of acid concentration, temperature, and addition of boiler scale on the corrosion rates.

ATOMIC POWER

Atomic Power Engineering — Some Nuclear Problems, *by A O Nier, University of Minnesota, Minneapolis, Minn.* The author, in a highly understandable fashion, presents the basic engineering considerations involved in the production of power from nuclear fission, pointing out that the problem of producing atomic energy is largely one of making efficient use of neutrons. The many factors involved in such efficient use are clearly presented and the new terms involved are defined and explained.

Atomic Power Engineering—Some Design Problems, *by B R Prentice, General Electric Co, Schenectady, N. Y.* Describes a relatively simple possible arrangement of facilities for production of atomic power, examines the availability of fissionable materials, and discusses the disposition of the

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*



It's time to insist on SAFE wiring again

NOT so long ago, material shortages and other emergency demands forced practices on the electrical industry that did not meet code requirements. For example, people got temporary permission to use open wiring, and other less-than-safe systems.

Now that the emergency is past, common sense dictates a return to safe practice. Temporary wiring should be replaced. In new construction, only the best methods should be followed--and in electrical construction "best" means "safest."

REMEMBER that the only wiring system approved by the National Electrical Code as moisture, vapor, dust and explosion proof in hazardous locations is a standard-threaded rigid conduit.

Youngstown's "Buckeye" is the most widely used full-weight, rigid-steel conduit in the world. It is stocked and sold by leading electrical distributors in every industrial market. Specify "Buckeye" and be safe.

BUCKEYE YOUNGSTOWN CONDUIT

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

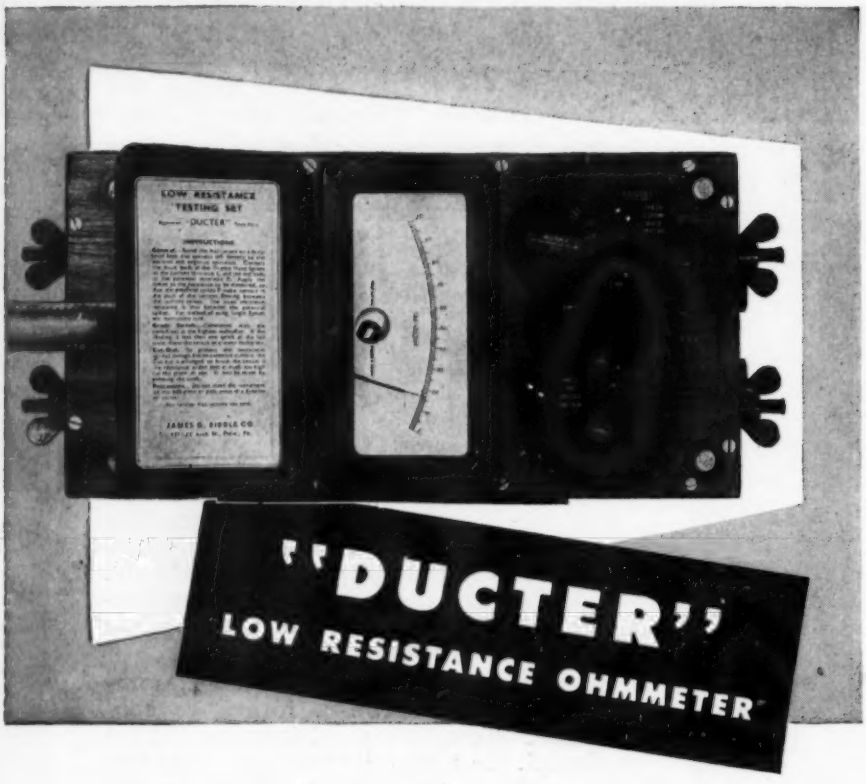
GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Ask your distributor for Youngstown Buckeye Conduit, Pipe and Tubular Products, Sheets, Plates, Electrolytic Tin Plate, Coke Tin Plate, Bars, Rods, Wire, Tie Plates and Spikes



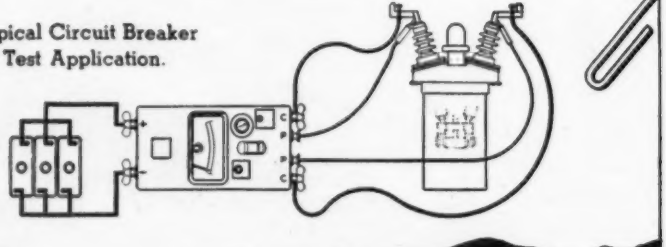
HERE'S a rugged, portable, direct-reading, and yet accurate *field* instrument for measuring resistance down to .000001 ohm (1 microhm) that can be taken right to the job and operated by *one man* simply applying a pair of hand spikes and reading the position of a pointer over a scale.

The "Ducter" Ohmmeter is invaluable for detecting trouble in switches and circuit breakers . . . for measuring any type of low electrical resistance or contact such as armature and transformer windings, soldered joints, etc.

In one operation, the "Ducter" Ohmmeter performs what otherwise requires more complicated equipment as well as both training and practice in low resistance measurement. You'll find the story of this member of the famous "Megger"* family of resistance measuring instruments in your free copy of Bulletin 24-25-P.

*REG. U. S. PAT. OFF.

Typical Circuit Breaker Test Application.



James G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.

output of such atomic-power facilities. After listing some of the engineering problems in the handling of products from reactors and in the chemical separation of fissioned materials, the author discusses at some length the design problems involved in development of reactors and production of electric power from the heat liberated in them.

Reactor-design problems include: (1) establishing conditions necessary to produce desired chain reaction (2) heat transfer at high rates and temperatures (3) special structural considerations growing out of the effect of radioactivity on the materials used (4) provision of means for loading and unloading the "fuel" and source material without loss of radioactive heat-transfer fluid or hazard to operators (5) control of neutron flux to regulate rate of power generation, and many other problems.

Estimating the time involved in reducing atomic power to commercial use, the author suggested that three to six years would be required to produce a high-temperature experimental controlled nuclear reactor. He estimated that a prototype of a practical large-scale reactor might produce, say, 100,000 kw of electricity, about ten years from now and that production of a large proportion of our power requirements by atomic means is from 20 to 50 years away, depending on the effort expended to bring it to reality.

HEAT PUMPS

A Review of Some Heat-Pump Installations, *by E B Penrod, University of Kentucky.* Defines the heat pump, explains the coefficient of performance, reviews some early domestic installations and development of commercial units, cites applications to railway cars, trucks and industrial processes, discusses some of the economic factors involved and presents an extensive bibliography.

Trunkline Gas Supply Co, Wilmington, Del., and Washington, D. C., has requested authority from Federal Power Commission to construct and operate a 30-in. natural-gas transmission pipeline extending from Wharton County, Tex., through Ark. and Mo. to Keokuk, Iowa, a distance of about 855 miles. Cost has been estimated at $74,266,507.

Southern Natural Gas Co has filed an application with Federal Power Commission for authority to construct and operate facilities to increase its system capacity from 255,000,000 to 490,000,000 cu ft per day. Total over-all capital cost has been estimated at $24,533,350. This application replaces an earlier request for authority to increase system capacity to 305,000,000 cu ft per day.

ONE *recognized standard*

THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

RESEARCH CORPORATION

NEW YORK 17. 405 LEXINGTON AVENUE
CHICAGO 3: 122 SO. MICHIGAN AVENUE

Eliminate these with De-ionized Water for your boiler feed

It's easy to eliminate all the above troubles with ILLCO-WAY De-ionizers. *Silica* in feed-water for high-pressure systems is reduced to less than .5 ppm. *Alkalinity* is readily and accurately controlled. Solids are removed, not replaced with less harmful solids. There's no problem of *carry-over*, no possibility of *caustic concentrations* causing *embrittlement*.

By removing dissolved solids, ILLCO-WAY De-ionizers give you a make-up water comparable to that produced by evaporation, but at 1% to 10% of the cost!

Keep your boilers clean, cut maintenance to the absolute minimum by treating make-up water by ion-exchange. Every ILLCO-WAY De-ionizer is backed by years of water-treatment experience. Write for literature describing this method today!

ILLINOIS WATER TREATMENT CO.
853-B Cedar Street, Rockford, Illinois
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TESTED IN THE LABORATORY ILLCO-WAY *PROVED IN THE FIELD*

Boiler Feed-Water Treatment

Complete equipment for Chemical Processing: Purification of Industrial Wastes, Separation of Chemical Solutions, Purification of Chemical Solutions, Reclamation of Valuable Constituents

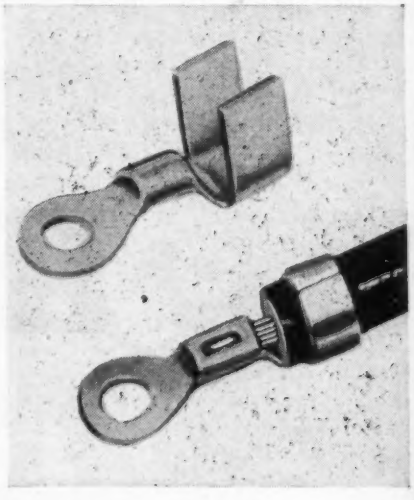
NEW EQUIPMENT

(*Continued from page* 140)

cation on standard constant-speed 1/3- to 2-hp 1750-rpm motors to give speed range of 1 to 3. Motor bases and belts are supplied with the sheaves, which may be installed on new machinery or on equipment already in service. **Dept P, Gerbing Mfg Corp, 154 E Erie St, Chicago 11, Ill.**

Welding Electrode

No. 575 ALL-POSITION ELECTRODE, with a high nickel core wire and heavy extruded coating, has a possible application for welding cast iron. Because of its high nickel content, welds are machinable, free from cracks and porosity, and have adequate tensile strength and ductility for cast-iron welding. They can serve with ease in the downhand, vertical and overhead position. Electrode is available in 5/32, 1/8 and 3/32-in. dia and may be used on ac or dc. **Dept P, Wilson Welder & Metals Co, 60 E 42nd St, New York 17, N. Y.**



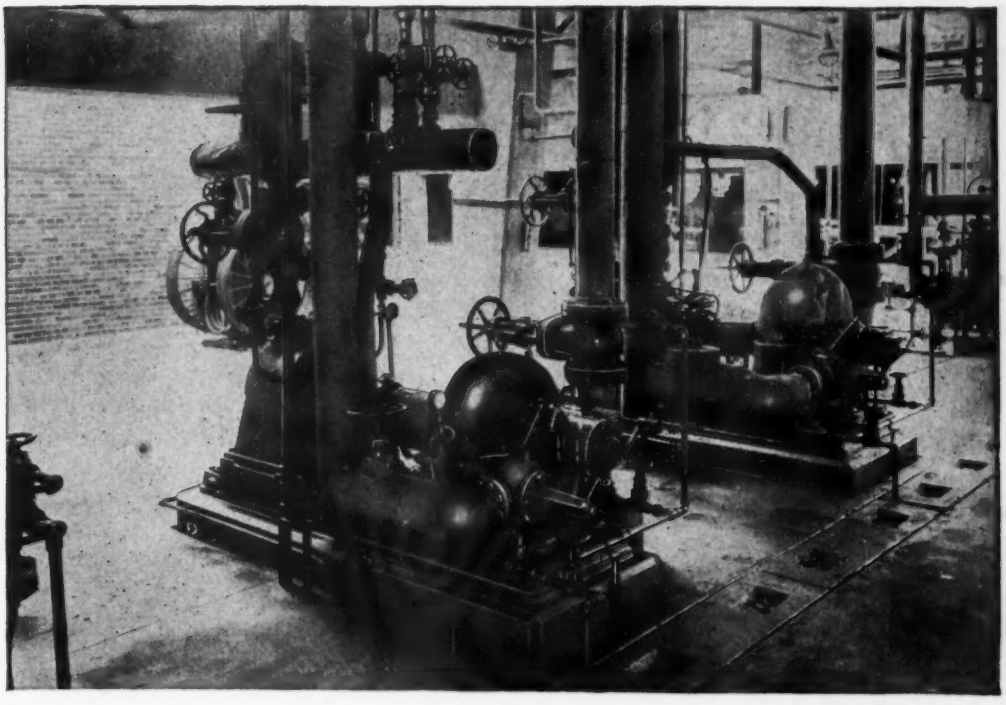
Small-Wire Terminal

NEW ONE-PIECE small-wire *Hylug* terminals accommodate the extra thick insulation of conductors frequently used in leads for switchboard wiring, radio transmitters and other electrical equipment. The tabs grip a wide range of insulation sizes and prevent fraying of insulation as well as breakage of conductor strands under extreme vibration. Connectors are indented into conductors by a *Hytool*. Longitudinal indent thus formed actually coins the metal into a solid mass, thus providing a permanent low-resistance connection. **Dept P, Burndy Engrg Co, 107 Bruckner Blvd, New York 54, N. Y.**

Rayon-Cord Belt

CONVEYOR BELT, with rayon-cord plies as a strength member, has been developed to meet needs of mechanized coal and metal mines, quarries and limestone plants, for

TERRY



THE ROTORS OF THESE 75 H. P. TERRY TURBINES ARE DOUBLE RIM PROTECTED

The two 75 H.P. Terry Turbines shown above (in the plant of a leading refiner) employ the Terry Solid Wheel Rotor. The wheel is made from a single steel forging and the buckets are milled directly into the wheel. — All as shown in the illustration at the left.

The buckets are protected by rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearing are not required to obtain safe and dependable operation.

This feature and many others of the Terry Wheel Turbine are fully discussed in our Bulletin S-116.

T-1169

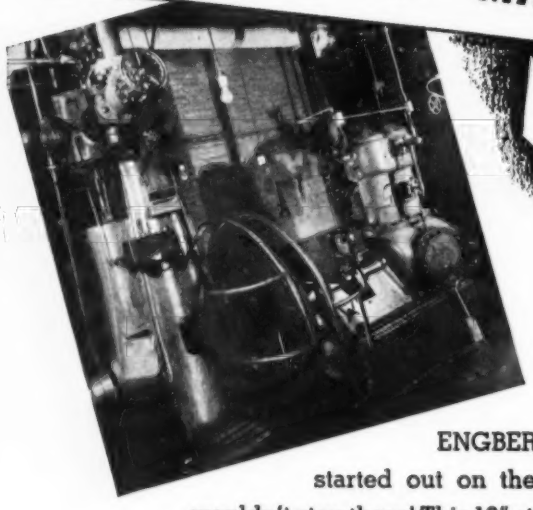
THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

TROY-ENGBERG STEAM ENGINE

THE STANDBY DRIVE

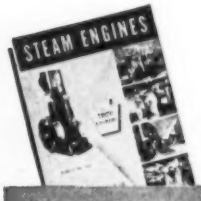
that soon became

THE MAIN DRIVE



Here is a TROY-ENGBERG STEAM ENGINE that started out on the second team but just wouldn't stay there! This 10" stroke Type E vertical unit hooked up to a well-known ice machine was installed in SIEBEN'S BREWERY CO., CHICAGO as a standby unit for a large horizontally driven machine. After a test run it was discovered that the TROY-ENGBERG unit could carry the load with the same or less steam consumption than the larger and supposedly more economical unit. Now the TROY-ENGBERG unit carries the full load and the big unit is relegated to the standby status.

If you use steam for heating or processing, you too can probably cut steam costs, which means power costs, by installing a TROY-ENGBERG Steam Engine and using By-Product Power to drive stokers, generators, compressors, pumps or blowers.

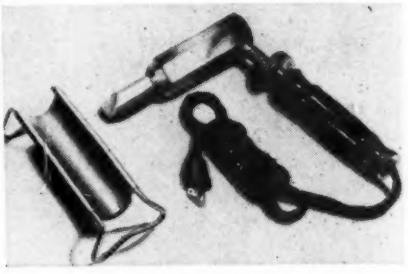


Send for Bulletin 306.

TROY ENGINE & MACHINE COMPANY
Established 1870
2500 Railroad Avenue Troy, Pennsylvania

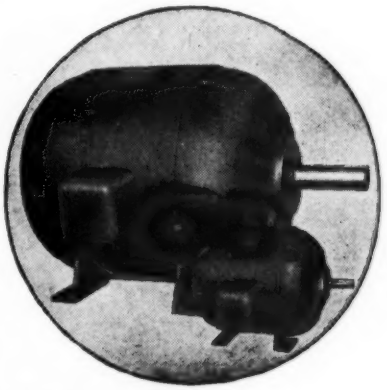
TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

a belt of higher tensile strength for heavy duty on long lifts. *Ray-Man Tension-Master* belt is intended to replace series of belt conveyors and thus it eliminates transfers from one conveyor to another. It troughs easily because of its fiber resilience, operates on standard idlers and pulleys, can be field spliced by conventional methods, and permits conveyor construction to suit varying service conditions. **Dept P, Manhattan Rubber Div, Raybestos-Manhattan, Inc, Passaic, N. J.**



Soldering Iron

HEXAGONAL-SHAPED heating-element barrel permits vise-clamping for easy removal of electric soldering iron tip. The 300 *H* features, its maker states, a high-heat alloy core that resists scale and prolongs life. The iron is of a hatchet design for ease in handling, with a 6-ft 10,000-cycle heater cord, hard-drawn copper tip, accessible terminals. **Dept P, Hexacon Electric Co, 131 W Clay Ave, Roselle Park, N. J.**



Induction Motor

NEW SERIES D INDUCTION MOTOR, in NEMA frame sizes from 203 to 505, is of drip-proof construction. It accommodates double sealed ball bearings or sleeve bearings. Ventilating openings are below center line with end air baffles directing incoming air over windings and out at side opening between feet. This method of ventilation, according to maker, permits low air velocities and quieter operation.

The rotor winding for frame sizes up to 365 is one-piece cast aluminum that is firmly and thoroughly embedded in closed slots. Rotor slots are also skewered for smoother and quieter operation. Fans cast in rotor winding provide ample air circulation.

For frame sizes from 404 to 505, construction is same as for frame sizes up to 365, except that rotor windings are made

ZINC can't get away!

. . . from Chase

ANTIMONIAL ADMIRALTY*

CONDENSER TUBES

THOSE wayward molecules of zinc are held strictly to the job in Condenser Tubes made of Chase *Antimonial* Admiralty. Millions of pounds of this patented Chase copper alloy have been installed since 1935—with remarkably good resistance to dezincification.

Next time you must replace worn tubes with new ones, specify Chase. You pay no more—and you'll find that you will not need to replace an *Antimonial* Admiralty tube so often. Write or phone the nearest Chase Warehouse or Service Office for information.

*U. S. Pat. No. 2,061,931

Special stocks of ANTIMONIAL ADMIRALTY Condenser Tubes in Chase Warehouses at BALTIMORE, NEW ORLEANS, LOS ANGELES, SAN FRANCISCO also carried by— Vinson Supply Co., TULSA Standard Brass & Mfg. Co. HOUSTON

Chase

WATERBURY 91, CONNECTICUT

the Nation's Headquarters for BRASS & COPPER

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Indicates Sales Office Only)

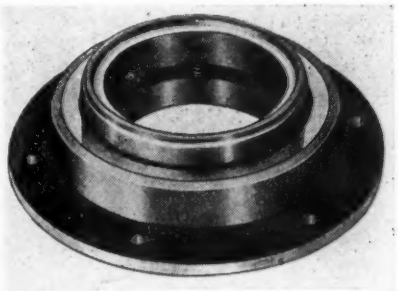
BUT A LAMINUM SHIM doesn't stop there. You get *certainty* of accuracy in factory assembly of gears and bearings of all kinds (with less supervision) plus the ease with which adjustments in service may be made with the same Laminum shim. Advantages too great to be minimized. Bulletin and application photo chart on request.

Laminum shims are cut to your specifications. For maintenance work, however, shim materials are sold through industrial distributors.

Laminated Shim Company, Inc.
61 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

of copper bar instead of cast aluminum. Extension of hard drawn copper strips provides necessary fan action. End bars are securely brazed to end rings to prevent displacement. All rotors are dynamically balanced after assembly to assure smooth, quiet operation. These motors are built in three types, namely, normal-starting torque, low-starting current; high-starting torque, low-starting current; high-starting torque, high slip. **Dept P, Burke Electric Co, 273 W 12th St, Erie, Pa.**



Carbon-Ring Oilseals

GITS DMC AND DPC HIGH-SPEED CARBON-RING OILSEALS are for applications on horizontal or vertical shafts where minimum lubrication is used, where seals run in liquid rather than oil or grease, or where shaft speeds are high. They have a low coefficient of friction and self-lubricating qualities that suit them to high rubbing speeds. Sealing principle eliminates shaft wear and need for replacing grooved shafts. They seal against leakage of liquids or gases under pressure or vacuum by a radial seal joint between a stationary and a rotating lapped surface. Sealing surfaces do not contact shaft but transfer the wear to radial seal joint. Built as compact units, they require small diametrical and axial space. Where light weight is needed, most of seal parts are made of aluminum. **Dept P, Gits Bros Mfg Co, 1846 S Kilbourn Ave, Chicago 2, Ill.**

One-Piece Hinged Connector

AVAILABLE IN 25 SIZES, accommodating over 400 wire combinations ranging from No. 8 to 1,000,000 cir mil, the *XTP* does practically all tap jobs. Its wide range reduces number of connectors a user needs to carry in stock. One-piece hinged construction makes this connector quick and easy to install. It can be permanently attached to main line and have the tap attached later. One end of the connector is simply snapped over main line and tightened. The other end has serrated openings into which a tap can be run in any of three directions.

Advantageous construction features are:

TO CUT COSTS

Get Savings from your BOILER ROOM

THE savings that can be made in fuel alone (oil, coal, gas) will help you to level off the high costs that prevail today. Because of this the boiler room becomes a logical place for you to begin and successfully fight rising costs.

YOU CAN DO THAT KIND OF A JOB WITH

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

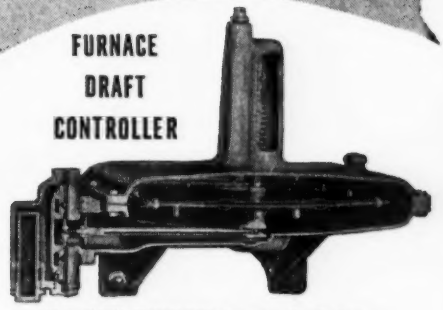
HERE you have a sure-fire method of saving for reason that with this system you maintain correct fuel-feed — the correct fuel-air ratio and constant over-fire draft.

The result of all this is that your fuel consumption will be materially lessened for the steam you require. Combinations of the various CASH STANDARD units can be made to make a dependable, cost-saving Automatic Combustion Control System to meet any specific condition and work on any boiler or stoker with any kind of fuel.

12 PAGES OF DETAIL ON STEAM PLANT *Economy*

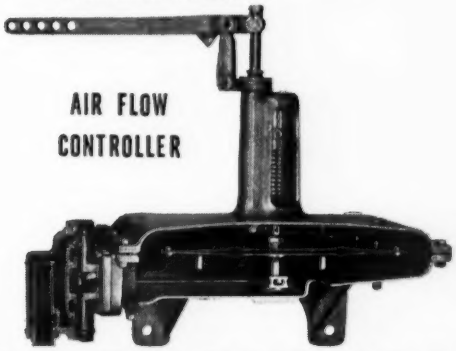
Our booklet No. 300 is prepared so that whether you burn coal, oil, or gas you will see how CASH STANDARD Units can be applied to your boiler to effect immediate and continuous cost-savings.

FURNACE DRAFT CONTROLLER

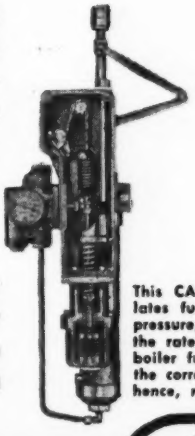


This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from over-fire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

AIR FLOW CONTROLLER



This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

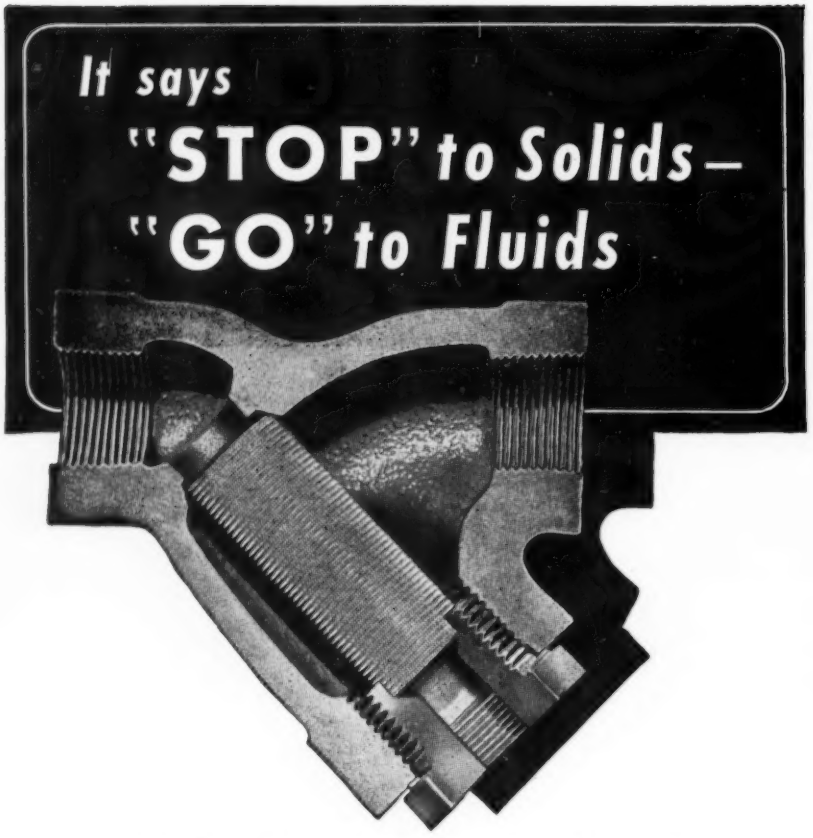


FUEL FEED CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion—hence, money saving.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES



A BETTER Strainer to "police your pipelines"

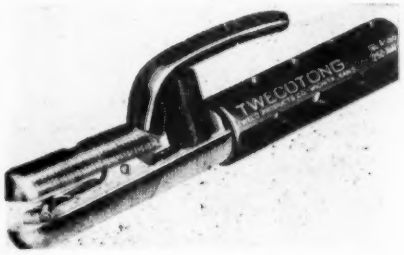
- **FIRST**—*The Screen*, a high-grade woven Monel wire basket that catches solids—lets condensate, oil or other fluids flow freely.
- **SECOND**—*Finish*. Cadmium plated for protection against corrosion and for better appearance.
- **THIRD**—*Easily Cleaned*. Blow-off bushing made for easy removal. Bushing and Screen come out together. Screen automatically aligns on reassembly.
- THOUSANDS IN SERVICE—Sold by nearly 150 Mill Supply Houses.

6 sizes from ½" to 2" for pressures up to 600 lb. Reasonably priced. See your supply house or write for Bulletin S-201.

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

(1) A tin-plated spring-steel washer maintains permanent pressure. (2) Grip-holding serrations are on wire-contact surfaces for maximum pullout strength. (3) Pressure plates are nonrotating. (4) Body is high-conductivity copper alloy. (5) It has extra-strength copper-alloy hinge and pressure plate. **Dept P, O Z Electrical Mfg Co, 262 Bond St, Brooklyn, N. Y.**



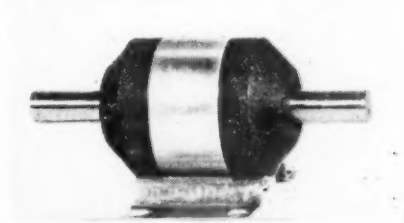
Electrode Holder

A-316 TWECOTONG ELECTRODE HOLDER is a smaller companion to the *A*-14 and *A*-38 insulated electrode holders that have been on the market for some time. The *A*-316 device features light weight, compactness and ease of operation, with a 95-lb hold on a 3/16-in. electrode. Insulated spring is *Neoprene* covered. Capacity is 1/16 to 3/16-in. size electrode, 250 amp. **Dept P, Tweco Products Co, P O Box 666, Wichita 1, Kan.**

Smoke Indicator

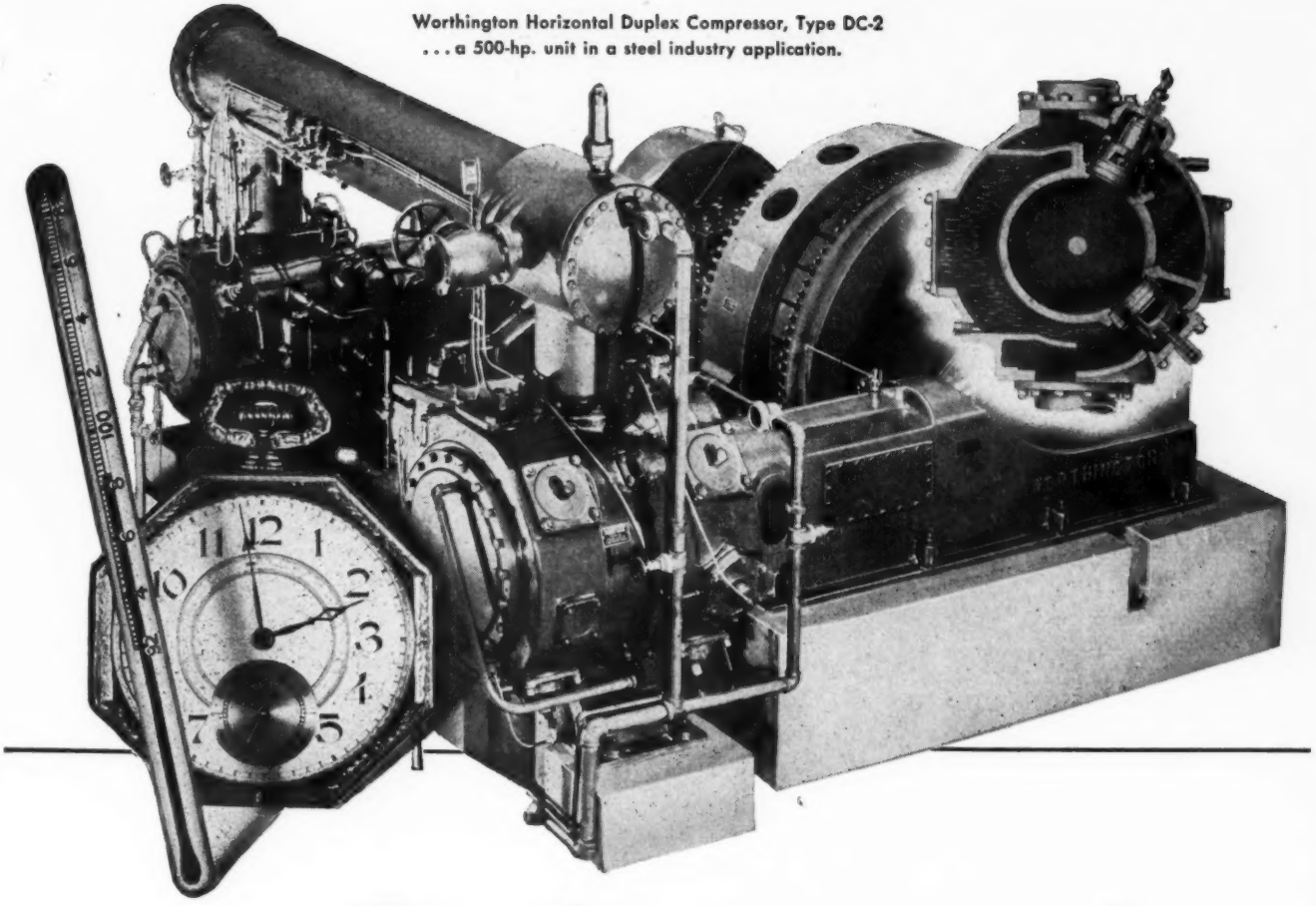
PHOTOELECTRIC 3-PIECE INDICATOR gives warning of smoke formation. Two of the three pieces mount in stack or in breeching so the exit gas on its way to the atmosphere must pass between them. A light from one to the other dulls as smoke intensity increases and a photoelectric cell registers this change in light.

The third piece, the *Hazegage*, is a meter that indicates light strength at any given moment. If desired, the meter zero or center setting can be at a selected light intensity or *Ringelmann* scale point. A departure from this selected setting to one where local ordinances might be violated will light a red signal or ring a bell. **Dept P, Ess Instrument Co, Bergenfield, N. J.**



Small Speed Changers

MINIATURE SPEED CHANGERS are for instruments, controls, experimental work or wherever speed of small power devices is to be increased or decreased. With a length of 2 11/16 in. and 1 1/16 in. in dia, they are available in gear ratios of 15 to 1 1/9 to transmit power in either direction. Speed up to 20,000 rpm and torques of



Worthington Horizontal Duplex Compressor, Type DC-2
. . . a 500-hp. unit in a steel industry application.

PULSE: *Rapid* TEMPERATURE: *Low*

Typical of the way Worthington builds "top efficiency" into big compressors are the precautions taken to reduce temperature of the cylinders and valves of Worthington Type DC-2 units . . . a line of hard-workers from 75 to 3000 hp.

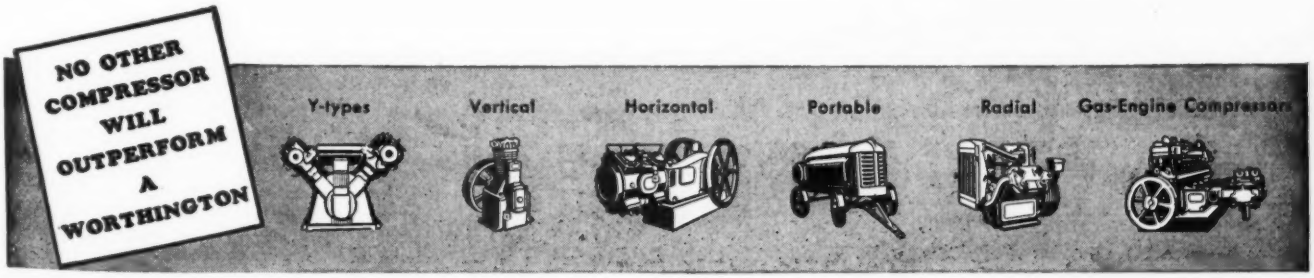
Water jacketing around the cylinder and in the heads keeps temperature . . . and, therefore, power consumption . . . at a minimum. Valve locations receive cooling from both cylinder and head jackets. The exclusive Worthington Feather* Valves — lightest, tightest, most efficient ever devised — reduce air or gas friction to a minimum.

WRITE FOR BULLETIN L-675-B1A

Write for your copy of this 32-page bulletin today and learn why—in compressors as in so much other equipment — *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

*REG. U. S. PAT OFF. K7-8

WORTHINGTON



"Flexitallic" GASKETS
How Flexitallic Precision Brings a New Degree of Safety
for sealing steam and other fluids under pressure
FLEXITALLIC GASKET CO.
8th & Bailey Sts.
Camden, N. J.

NEW SAFETY IN GASKETS
—will you read about it?

This new little book speaks of safe-sealing for fluids under pressure with the plain honesty the subject of safety deserves.

It tells with sketches and few words how the "Flexitallic" art which established itself in wide use through safe performance has now put safety on a new level.

You are not asked to abandon one theory and accept another. The book deals with a record of performance and identifies the practices that make the record possible. You are urged to believe only what pre-testing can—and will—prove to you.

WE'LL SEND YOU A COPY

A post-card will serve but you will help us in record-keeping by giving us the name of your company and your title or department.

"Flexitallic"

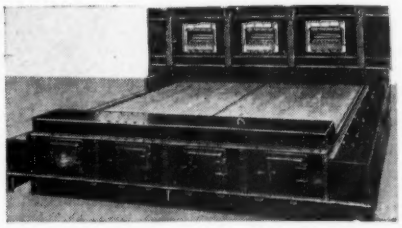
GASKETS OF THIS NAME ARE MANUFACTURED ONLY BY

FLEXITALLIC GASKET COMPANY

ORIGINATORS OF SPIRAL-WOUND GASKET CONSTRUCTION

8th & BAILEY STREETS CAMDEN, N. J.

2 lb-in. are permissible for some applications. Hardened spur gears are used with their drive shafts concentric and mounted in permanently lubricated ball bearings. Intermediate gears are mounted in graphitic-plastic bearings so that lubrication is not required except at high loads. **Dept P, Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.**



Spreader Stoker

LOW-GRADE ash fusion coals burn with high efficiency on a combined spreader feed and traveling-grate stoker, the manufacturer states. *Travl-Spred* stoker has non-sifting tuyeres with orifices below the grate line to diffuse air through openings at this level. Air criss-crosses from these orifice discharge openings, which comprise 7% of total grate surface.

Three burning area zones are present with three manually adjusted openings for fire control over grate length. The grate moves at about 4 ft. per hr under a ½ hp hydraulic-oil drive. This drive is built in the air-duct extension under boiler sidewalls. **Dept P, Wm Bros Boiler & Mfg Co, Minneapolis, Minn.**

Hand Hammers

PLOMB HAMMERS have a plastic, known as *Nuplaflex*, for the tips. They are intended for use on threads, painted, polished and plate surfaces, and any other parts that would be marred, scratched or otherwise damaged by metal hammers. Tips of the same size are interchangeable, so that a hard and extra soft tip are used on one hammer. They can serve in fire-hazardous areas where sparking is dangerous, for general machine shop application, machine repairs and adjustments, metal forming, driving dowels and other cabinet-making work, or for hammering frames that hold glass. **Dept P, Plomb Tool Co, 2209A Santa Fe Ave, Los Angeles 54, Calif.**

Dust Collector

PERMANENT-MOLD ALUMINUM CASTING gives a compact, lightweight tubular dust collector. *Aerotec* 3 has a small diameter, 3 in., and flush inlets that, it is stated, give increased centrifugal force within the cast aluminum tube.

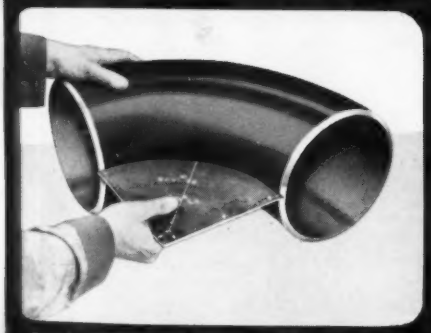
Tests to determine the tube's resistance

UNIFORM WALL THICKNESS

Ladish Seamless Welding Fittings agree with pipe sizes in both inside and outside diameters, thus OD alignment automatically insures ID alignment. This prevents harmful offsets that cause turbulence and pressure loss.

SMOOTH INNER SURFACES

Uniformly smooth inner surfaces, free from buckling and irregularities, reduce frictional resistance and minimize pressure drop throughout the entire piping system.



FULL EFFECTIVE RADIUS

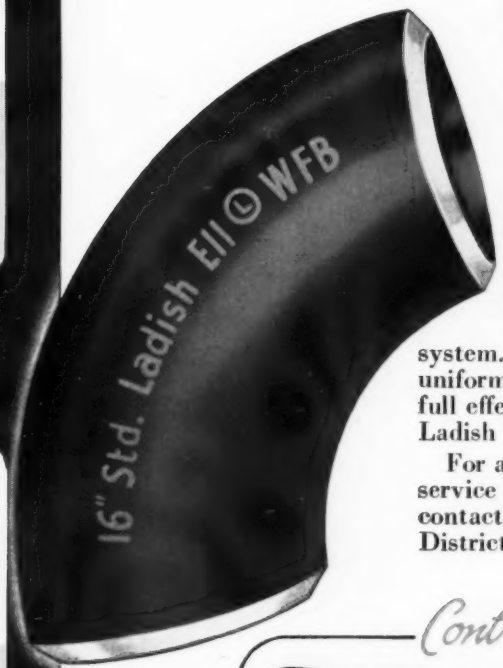
Being true arcs of circles, Ladish Ells and Return Bends reduce turbulence and pressure loss because changes in flow direction are uniform and gradual at all points around the fitting.

TRUE CIRCULARITY

True circularity and full diameter safeguard against pressure loss and undercutting caused by flattened or distorted surfaces.

For MAXIMUM Flow Efficiency

INSTALL LADISH SEAMLESS WELDING FITTINGS



Modern piping practice . . . with its steadily mounting pressures and velocities . . . demands fittings which have been carefully designed to reduce turbulence, frictional resistance and pressure losses to a minimum.

Ladish Seamless Welding Fittings are designed and produced under the most rigid controls to insure not only the strength and toughness needed to withstand these stresses—but to provide features that maintain smooth, undistorted flow throughout the piping system. The panel at left explains how the uniform walls . . . smooth inner surfaces . . . full effective radii . . . and true circularity of Ladish Fittings promote flow efficiency.

For additional information, and for prompt service in meeting your fittings requirements, contact your nearby Ladish Distributor or District Office.

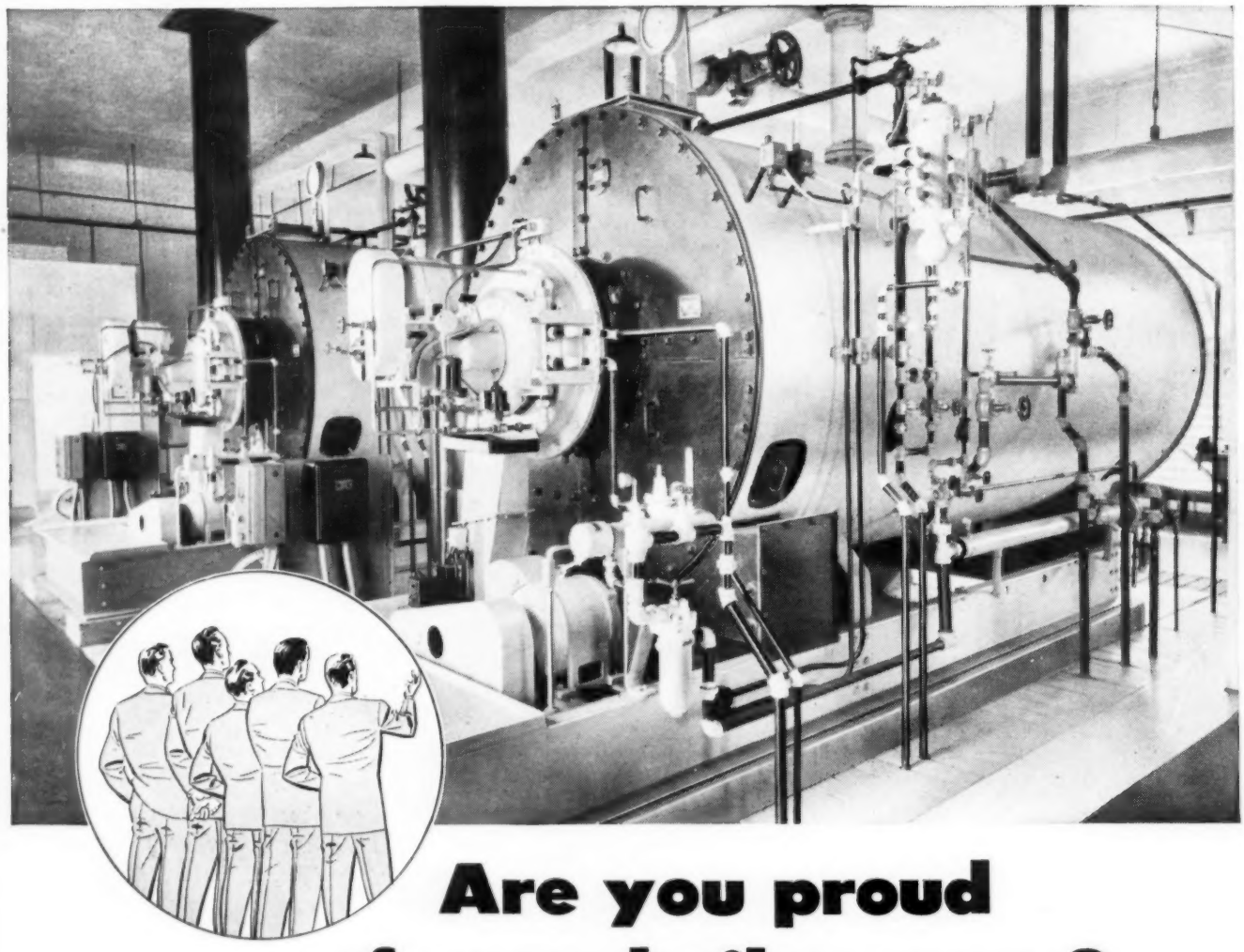
TO MARK PROGRESS

Controlled Quality
FITTINGS

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

DISTRICT OFFICES:
New York • Buffalo • Pittsburgh • Cleveland • Chicago • St. Louis • Atlanta • Houston • Los Angeles



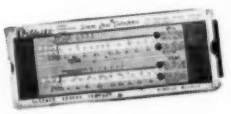
Are you proud of your boiler room?

Cleanliness and efficiency usually go hand in hand. Replace your old inefficient, unsightly steam plant with a modern Cleaver-Brooks "packaged" steam generator. Its modern design, its well integrated construction — its clean, smokeless efficient operation (no ashes, dirt or soot to contend with) assure a show place boiler-room like the one illustrated above.

There are more "packaged" Cleaver-Brooks steam generators serving a wider range of steam needs than any other make. Cleaver-Brooks units have been serving all industry for more than 15 years. Check your operating budget — do your steam costs seem excessive? Cleaver-Brooks will be glad of the opportunity to work with you to see if they can be profitably and substantially lowered. Remember, Cleaver-Brooks can help you plan your steam generation needs to meet not only current loads but to provide for future expansion as well.

- Low operating costs: unsurpassed guarantee: — 80% thermal efficiency from full load down to 30% of its rating:
- Quick steaming—for any emergency or fluctuating loads — through high heat transfer.
- Fast installation. No special foundation needed. No smoke-stack required, only simple roof-high vent. Saves space, fits into low head-room locations. Oil-firing provides clean smokeless operation.
- FACTORY-FINISHED AND TESTED — a "packaged" unit meeting all code requirements.
- SIZES: 15 to 500 h.p., pressures from 15 to 200 p.s.i. (Write for bulletin and complete information.)

CLEAVER-BROOKS COMPANY
326 East Keefe Avenue, Milwaukee 12, Wisconsin



WRITE on your business letterhead for the Free Steam Cost-Calculator — a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

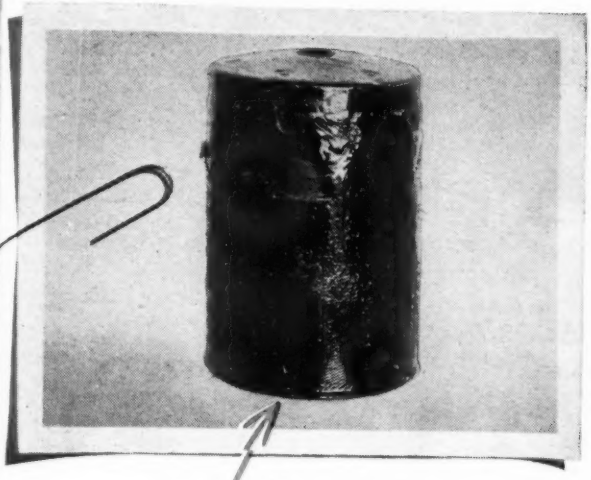
Cleaver-Brooks

"Packaged" STEAM GENERATORS

HAVE SERVED INDUSTRY FOR MORE THAN FIFTEEN YEARS

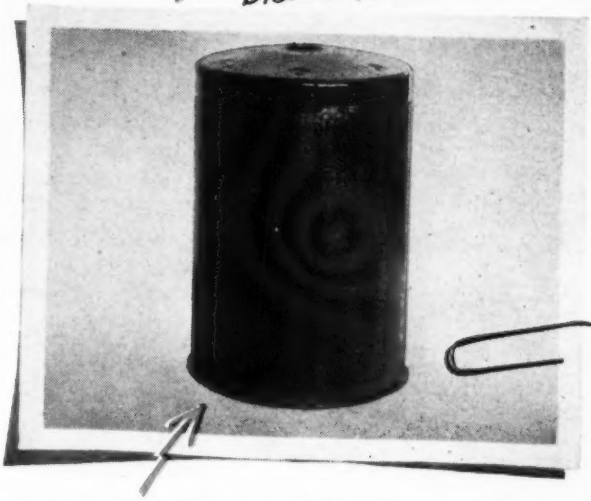
LUBE MEMO

How Joe stopped Filter Clogging



Joe says filters have gummed up like this after about 600 hours on oil he's been using

Joe says nothing but RPM Delo Oil in his Diesels from now on



Here's how the filter looked after 600 hours on RPM Delo Diesel Engine Lubricating Oil

Joe finds RPM Delo Oil keeps filters clean because:

1. It's compounded to resist oxidation and minimize sludge.
2. Its "detergent" cuts down sludge.
3. It remains stable in the presence of moisture.

DIESEL ENGINE RPM DELO LUBRICATING OIL

Set up trial on RPM Delo Oil Today!

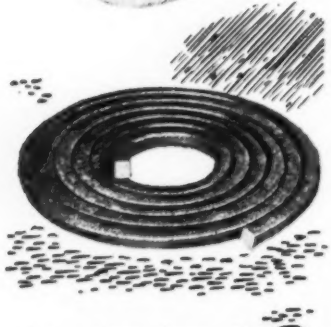
STANDARD OF CALIFORNIA • San Francisco, Calif.
THE CALIFORNIA COMPANY • Denver, Colo.

STANDARD OIL COMPANY OF TEXAS • El Paso, Texas
THE CALIFORNIA OIL COMPANY • New York

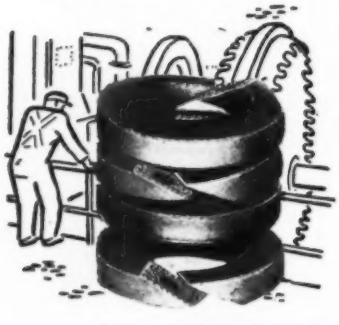
BELMONT
PACKINGS
solve sealing problems

These three packings are representative of the extra values built into each product in the complete Belmont line. For every service . . . steam, water, oil, gas, acids, alkalis, ammonia . . . your Belmont Distributor has the right packing.

BELMONT #30 For High Pressure Steam Rods and Expansion Joints. Center block pleated on itself (accordion fashion) at approx. 90° angle with rod, affording, high resiliency and flexibility, extra take-up, extra "edge wear" if packing wears toward the rod.



BELMONT #189 For Hot Oil Rods and Plungers. Has extra resistance to penetration. Long-fibre asbestos yarn is firmly braided, each strand treated with a special compound so that saturation and penetration are minimized.



BELMONT #19 Hollow Center Packing For Intermediate and Low Pressure Steam; Hot and Cold Water Rods and Plungers. Hollow Center permits expansion and contraction. Packing "breathes" toward the hole, so friction is kept at minimum point created by the working pressure itself.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

Belmont Packings are available in every large industrial center, through Belmont Distributors.

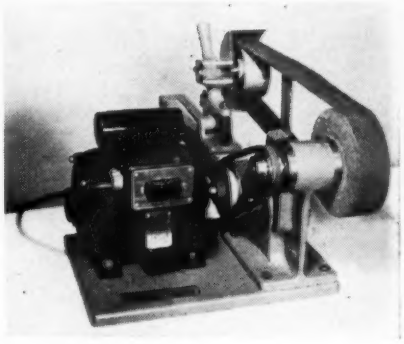
THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

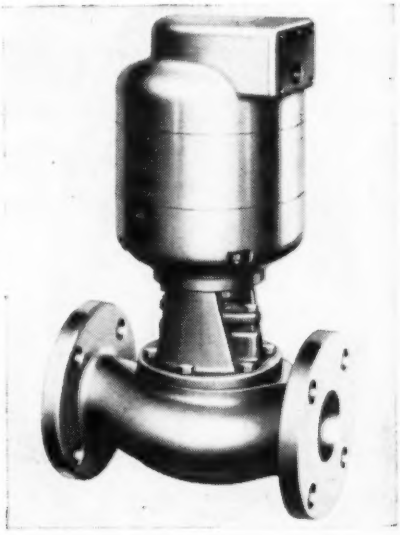
THE BELMONT PACKING & RUBBER COMPANY
BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

to the abrasive action of flyash indicate the casting is comparable to cast iron and, according to manufacturer, permits closer production tolerances. **Dept P, Thermix Corp, Greenwich, Conn.**



Utility Grinder

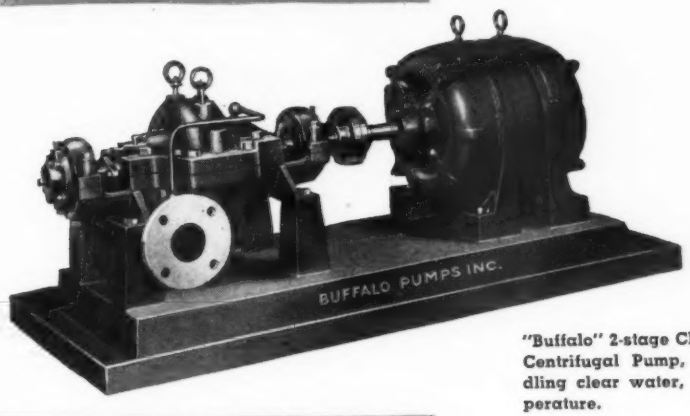
NEW MACHINE provides advantages of grinding on an abrasive belt operating over a resilient contact wheel. Since wear is on abrasive belt and not on supporting wheel, it remains flat, square at corners or sides, and maintains its diameter and balance. Work can also be done on the free or unsupported abrasive belt, such as grinding contours, following a pattern, or cleaning up otherwise inaccessible points. **Dept. P, Porter Cable Machine Co, Syracuse, N. Y.**



Circulating Pump

MODEL 1-B RUMACO centrifugal circulating pump has opposing inlet and outlet for 2-in. 125-psi pipe flange. Pump can be easily installed in different size pipelines by pipe reducers, and operates in any position from vertical to horizontal. It is designed for hot-water circulation in domestic and industrial heating systems, but may serve for many circulating purposes. Totally inclosed driving motor, direct connected to pump, has grease-packed precision ball bearings that do not require added lubrication. Motor is dynamically balanced to close limits for quiet operation. **Dept. P, Ruthman Machinery Co, Cincinnati 2, Ohio.**

MORE water . . . for LESS money!



"Buffalo" 2-stage Class "RR" Centrifugal Pump, for handling clear water, any temperature.

Lower Power Costs

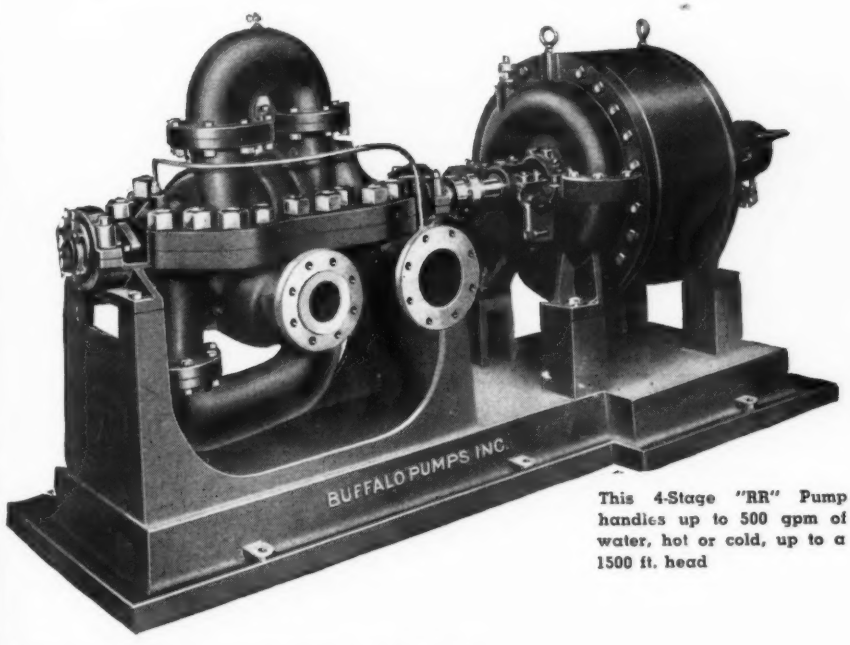
Power costs, when computed over the months, ADD UP! But you can trim these costs by making sure of PUMPING EFFICIENCY. "Buffalo" RR Pumps are giving just this kind of economy in countless installations. Their quiet, vibrationless performance means perfect hydraulic balance — no waste of driving power — and impellers are designed to handle MORE gallons of water per kilowatt-hour.

Lower Upkeep Costs

If a pump isn't built to "take it," any initial saving in cost is nullified. This is why "Buffalo" Pumps are built "heavy," with oversize bearings, shafts, and extra deep stuffing boxes — why you can practically install a "Buffalo" Pump and forget it, as far as maintenance is concerned.

One user recently reported his "Buffalo" Pump "still going strong — after 35 years!"

SPECIFY "BUFFALO" — GET MORE WATER FOR LESS MONEY IN YOUR PUMPING! Write us for all the facts.



This 4-Stage "RR" Pump handles up to 500 gpm of water, hot or cold, up to a 1500 ft. head

BUFFALO PUMPS, INC.

488 BROADWAY — BUFFALO, NEW YORK

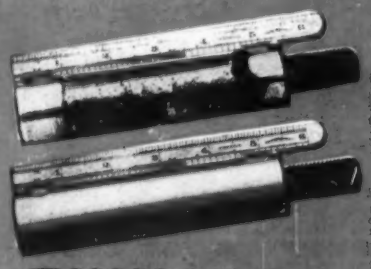
Canada Pumps Ltd., Kitchener, Ont.

"Buffalo"

CLASS "RR"

MULTISTAGE PUMPS

LUBRIPLATE



THWARTS CORROSION!

These originally identical shackle pins from a ten ton truck were used in a comparative lubrication test for a period of one year. A well known conventional lubricant was used on the upper pin. Note the pitting from corrosion, also the excessive wear. LUBRIPLATE was used on the lower pin. Its surface remained bright and true as when the test began, proof that LUBRIPLATE is different . . . better.

LUBRIPLATE

Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE

Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE

Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

LUBRIPLATE

FISKE BROTHERS REFINING CO.

NEWARK 5, N. J. TOLEDO 3, OHIO

DEALERS FROM COAST TO COAST

CONSULT YOUR CLASSIFIED TELEPHONE BOOK

Power News

(*Continued from page* 138)

of the fall, the fusibility of the roof itself, and other factors would not alter control of the flame or even make the operation impossible," according to Milton H Fies, manager of coal operations of Alabama Power Co and father of the experiment. "The roof action is a problem, and it is not going to be solved in a day," he said.

Two results of the experiment were particularly encouraging, according to Fies and other experimenters. One was the fact that inspection of the burned-out area underground showed that the coal was burned clean, there was very little coke, and the ashes were where they belonged, at bottom of shaft. The second encouraging result was that despite roof "flows," which appeared to clog entries, it was still possible to get comparatively free air passage to limit of the blower.

Union Carbide & Carbon Corp has under way a commercial experiment in reclamation of raw materials for synthetic chemicals through underground gasification of coal. This goes several steps beyond the recent experiment, conducted by Alabama Power Co and Bureau of Mines at Gorgas, Ala.

Carbide's experiment, which has been under way for some time at its Charlestown, W. Va., plant, had been considered only in the realm of possibility by government researchers. Details on the project, which is part of a long-range program looking toward replacement of raw-material sources for synthetic chemicals, are being withheld by the corporation pending completion of a complete technical report.

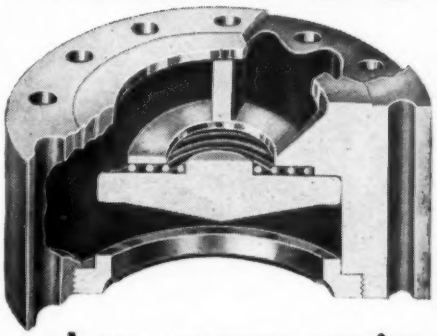
Walter J Rider Co, 324 Water St, Binghamton, N. Y., has been incorporated, with capital of $150,000. The concern manufactures, services and deals in power equipment. Incorporators are Walter J Rider, Harriette T Rider and Prescott D Perkins.

Annual Charles A Coffin Award by General Electric Co to a public utility "for outstanding public service and benefit to American industry," was presented the New York State Electric & Gas Corp on June 4 at the 1947 convention of the Edison Electric Institute in Atlantic City.

Three Monsanto Chemical Co industrial scientists have been awarded leaves of absence at full salary by the company for an academic year of study at universities of their choice. The awards embrace the school year 1947-48. This year's group includes Milton Kosmin, Costas H Basdekis and Paul John Stuber.

"WATER HAMMER" CAUSING TROUBLE IN YOUR PLANT?

THE WILLIAMS-HAGER *flanged* SILENT CHECK VALVES



. . . have proven service records of more than 17 years without repairs or removal from the line

on Heavy Duty Service for Public Utilities, Water Works, Industrial Plants, Oil Refineries, Paper Mills, Chemical Works, Private and Public Buildings, Hospitals and other Institutions wherever dependability, economy and *silent operation* is essential.

Write for new bulletin!

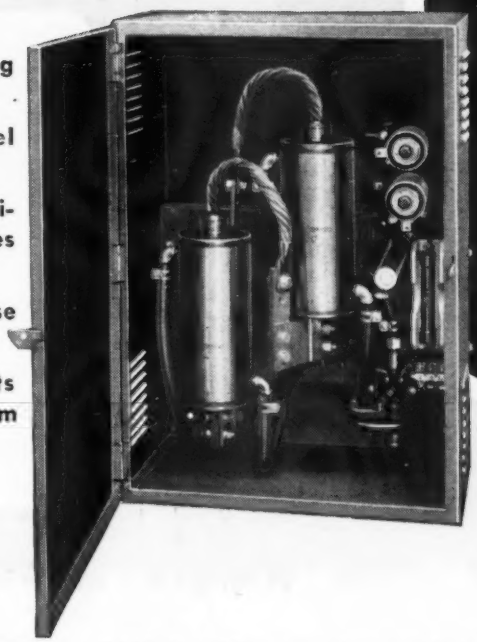
THE WILLIAMS GAUGE CO.

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns

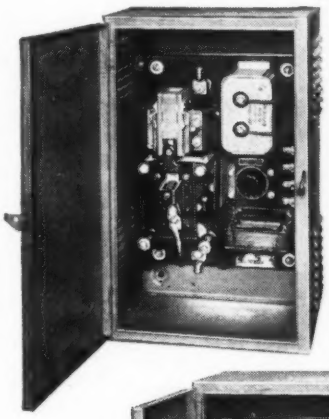
2055 PENNSYLVANIA AVE. · PITTSBURGH (12), PA.

Announcing a new Electronic WELDER CONTACTOR

- Generous wiring space.
- Removable steel base plate.
- Heavy steel cabinet with drain holes and louvres.
- Flat door for close ganging.
- Control elements grouped away from tubes and cables.



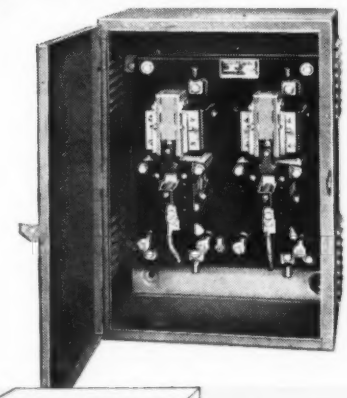
SQUARE D COMPANY
INDUSTRIAL CONTROLLER DIVISION
MILWAUKEE, WISCONSIN, U.S.A.



With Three Complete Lines Square D has the right contactor for each resistance welding job

Electronic contactors for jobs involving heat control, very short weld periods at heavy currents, or exceptionally high speed operation.

SYNCRO-BREAK contactors for production jobs where lower installed cost and economical operation are important. Especially desirable where welders must operate over a wide range of weld times and duty cycles. Synchronizing feature eliminates arcing and prolongs contact tip life.



HIGH SPEED contactors, single or two-pole, for greatest economy on jobs where loads are smaller and duty cycles less severe. Designed specially for welder service, with knife-edge bearings, low-inertia moving parts and powerful blowout coils.

Write for BULLETIN 8990, describing all three lines of contactors. Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin.

Square D builds *Safront* weld and sequence timers suitable for use with any of the three contactor designs. Write for BULLETIN 8991.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

INCREASED FUEL COSTS *demand* INCREASED BOILER EFFICIENCY!

. . . regardless of the size of your boiler plant we can offer equipment to increase boiler efficiency!

1. Draft control for start-stop oil burners or stokers.
2. Position-type control for oil, gas and coal.
3. Metered control systems for oil, gas and coal.
4. Electric Eye control systems for oil.
5. Electric Eye smoke Indicators.
6. Electric Eye control for overfire air jets.

We invite inquiries and will gladly send, upon request, a copy of our fully illustrated booklet, "Automatic Combustion Control For All Sizes Of Boilers". Write today.

25th ANNIVERSARY

BROOKE ENGINEERING CO., INC.
4517 Wayne Avenue · Philadelphia, Pa.
MANUFACTURERS OF THE FIRST SUCCESSFUL ELECTRIC EYE SYSTEM OF COMBUSTION CONTROL

DEMA Sponsored Program For Diesel Instructors

Diesel Engine Manufacturers Association sponsored a conference program for teachers of diesel engineering during week of June 23 at Chicago. The conference was attended by about 72 men, representing 52 schools in all parts of the country.

Illinois Institute of Technology was host for the first day. Various men of the Institute spoke to the group on diesel engines and gas-turbine locomotives. They then inspected laboratories of IIT and Armour Research Foundation.

International Harvester Co was in charge of the program on June 24 at Melrose Park. Talks were given on the following subjects: Educational program within the company, educational aids to colleges and universities, job opportunities for mechanical engineering graduates, past and future research and development, test laboratory procedure, etc. The group were shown a diesel-engine film. A shop and engineering design dept tour was made. The group also went to Hodgkins Test Facility.

On June 25 the program was in charge of Northwestern University's Technological Institute. There were inspections of laboratories, laboratory demonstrations and informal lectures. The lectures were on experimental stress analysis, photoelastic and stresscoat analysis, foundations for heavy machinery, engine indicators and diesel applications, combustion engine fuels.

General Motors Corp was host at its LaGrange plant on June 26. Talks were given on General Motors 2-cycle diesel engine, job opportunities at Electro-Motive, work of diesel locomotive training center, educational aids at Electro-Motive and research in diesel fuels and coolants. The group also toured the plant, with special attention to engine manufacture and final locomotive assembly.

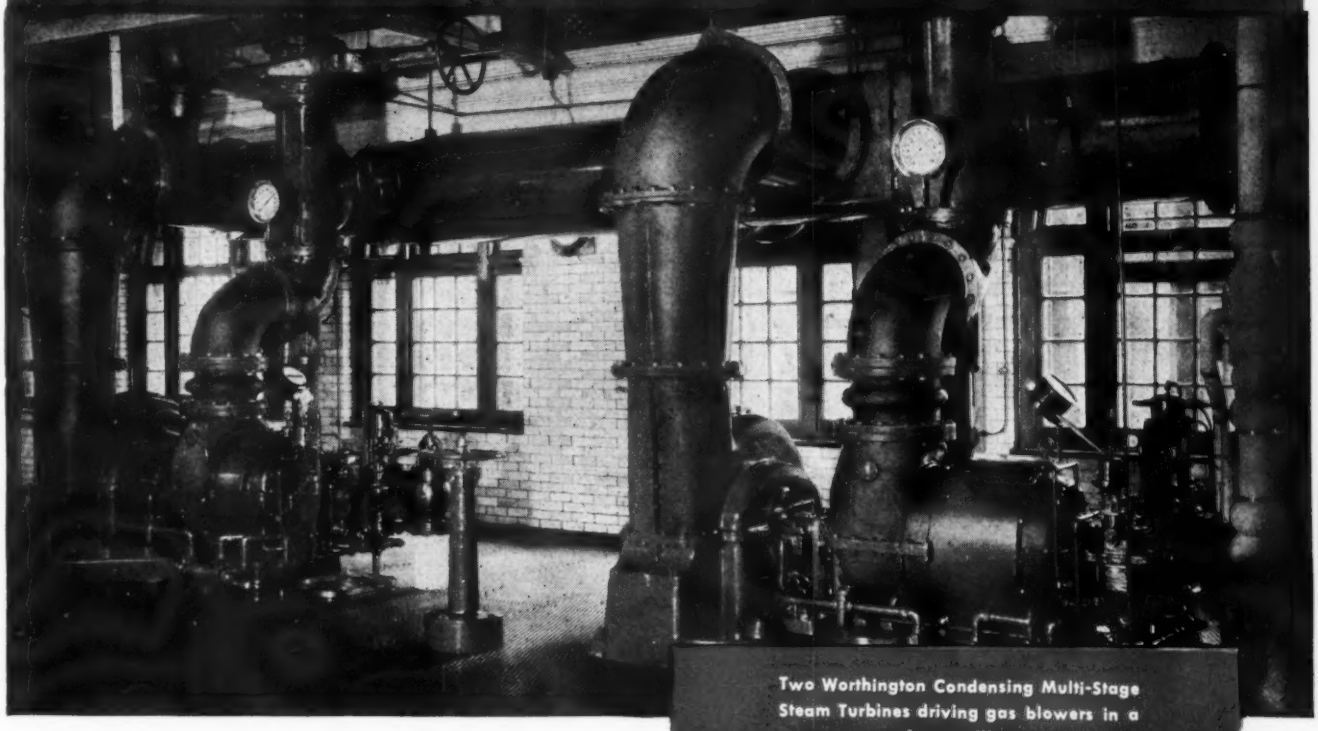
On June 27, Fairbanks, Morse & Co was host at its Beloit, Wis., plant. First there was a conducted tour of opposed-piston-engine manufacture and a demonstration of engine test. The lectures on the program were on research and development of diesel and dual-fuel engines. The plant tour included diesel-electric locomotives, magneto manufacture, diesel engineering dept, precision pump dept, diesel-engine manufacture, Fairbanks, Morse diesel powerhouse.

The sixth day's program, June 28, was held at the Bismarck Hotel, Chicago. There were talks on the following: "Thesis Subjects for Graduate Work," "Getting Equipment for Diesel Engine Laboratories," "Consulting Opportunities for College Professors in the Diesel Engine Field," "Elective Material a Mechanical Engineering Student Should Take If He Expects to Work in the Diesel Engine Field," "Memories of Dr Diesel as My Employer—Also. Highlights of Progress Along the Road of Diesel Engine Development."

Westinghouse Electric Corp has received an order to build a large turbine-generator for Detroit Edison Co. The new unit will produce 100,000 kw of electricity.

MORE POWER FROM YOUR STEAM

. . . with Worthington Multi-Stage Turbines



Two Worthington Condensing Multi-Stage Steam Turbines driving gas blowers in a large utility.

You will want to investigate Worthington Multi-Stage Steam Turbines for either condensing or non-condensing service. Worthington's familiarity with all phases of steam power and specialized knowledge of Steam Turbine engineering account for *low maintenance* and *smooth, dependable economic operation.*

Low steam consumption is inherent in the design of these turbines, built in sizes from 100 HP to 10,000 HP for operation on high or low pressure steam and for speeds up to 9000 RPM. For full descriptive literature, write *Worthington Pump and Machinery Corporation, Harrison, N. J.*

WHO USES THEM?

Worthington Multi-Stage Steam Turbines—condensing and non-condensing types — are now driving blowers, generators, pumps, line shafts, refrigeration compressors, air-conditioning units, paper machines, cane shredders, etc. Data that proves *there's more worth in Worthington* is available on request.

WORTHINGTON

T3-1

A GREAT TEAM IN STEAM

ALLPAX

. . . the **UNIVERSAL PACKING**

STOPS LEAKS PREVENTS SCORING LONG-LIVED

ALLPAX . . . the packing that packs *all* . . . eliminates packing waste and saves time and labor in packing. When worn so that the gland is taken up entirely, it is not necessary to replace with new packing . . . simply back off the gland and add a sufficient amount to fill the stuffing box. This feature of ALLPAX means economy in the use of ALLPAX as there is no waste, *all* of the packing being effective. Furthermore, the repacking job is faster and easier.

ALLPAX maintains its resiliency over long periods of service, conditions itself to a glassy, non-scratching surface and is guaranteed not to score the shaft.

All the advantages are in a packing that is recommended for hot or cold liquids or gases, and is available for all sizes and shapes of stuffing boxes. Try ALLPAX and see for yourself.

Your distributor can supply you.

THE ALLPAX CO., INC.

MAMARONECK, NEW YORK

RECESSED BRASS SEAT

This Exclusive Feature of JEFFERSON Specialty UNIONS assures PERMANENTLY TIGHT JOINTS

Jefferson Union Tee; made in All-Female and Male-Female types.

•

Consult your nearest distributor — or write us direct—on your requirements.

The leakproof tightness of all Jefferson Unions is attained by an exclusive, brass seating feature which provides a true ball joint so located as to provide free flow through the joint as well as absolute protection from screwed pipe ends coming in contact with the seat ring.

Completeness of the Jefferson line of Specialty Unions facilitates piping installation and assures better, simpler jobs with worthwhile savings in time, labor and materials.

JEFFERSON UNION CO.

601 WEST 26TH STREET, NEW YORK 1, N. Y.

LEXINGTON 73, MASS. **LOCKPORT, N. Y.**

BCR Pushes Coal Research

Annual meeting of Bituminous Coal Research, Inc, at Columbus, Ohio, June 3rd and 4th, featured the reports on the group's national research program.

Dr H J Rose, director of research, indicated BCR policy of increasing effective use of coal fuel in its present markets by research.

A report by E R Kaiser, assistant director of research, on the mining development program, revealed a proposed million-dollar project to produce mining machinery that will "simultaneously cut and load coal continuously."

Fundamental or basic research has been divided into three fields—gasification, carbonization and chemical reactions—reported Dr H C Howard, assistant coal research director of Carnegie Institute of Technology.

John I Yellott, BCR Locomotive Development Committee director, told of industry research designed to hold the largest single market for bituminous coal—fueling locomotives of the country. This research on the gas turbine promises operating savings, especially in fuel costs.

A panel of speakers—B A Landry, supervisor of the fuels div; Dr H W Nelson, assistant supervisor; R B Engdahl, another assistant supervisor; A C Richardson, supervisor of coal div; E D Benton, assistant supervisor, fuels div—presented contributions of Battelle Memorial Institute to BCR program.

W S Major, development engineer, BCR, outlined activities to stimulate use of overfire air jet as a "combustion tool."

Allis-Chalmers Mfg Co announces a construction and expansion program to cost several million dollars for the Pittsburgh works. The first major expansion of the Pittsburgh property since its purchase in 1927 by Allis-Chalmers includes a new 250x400 ft building, which will be devoted largely to production of transformers, major item manufactured by the company at Pittsburgh. Another smaller building at the New River plant will be used for shipping.

A G Christie, professor of mechanical engineering, Johns Hopkins University, Baltimore, Md., and Alfred Iddles, vice-president and director of Babcock & Wilcox Co, New York, N. Y., have gone to England to Centennial of the Institution of Mechanical Engineers as representatives of American Society of Mechanical Engineers. The celebration was on June 8-13.

An Engineering Reason, a film produced by Hathen Productions for Yarnall Waring Co, describes modern steam and mechanical engineering research that has been responsible for improvements in steam-plant auxiliaries. This 30-min color-and-sound film covers generation and steam utilization under low, medium and high pressures and temperature conditions. Write to *Yarnall-Waring Co, Mermaid Lane, Philadelphia 18, Pa.*, on company letterhead for free motion picture.

GET TO THE POINT

WITH AMSCO-NAGLE INDUSTRIAL PUMPS

AMSCO-NAGLE PUMPS GIVE GREATER SERVICE

Amsco design covers the two points that really determine the value of an industrial pump: (1) The service it will give and (2) The ease with which it can be maintained . . . any pump, worthy of the name, will handle the actual pumping.

Every feature of Amsco-Nagle Pumps is designed to resist abrasion and impact. Wide impeller clearances allow free passage of debris-laden liquids. Casing, impeller, and end plate are only parts contacting material being pumped—bearing housing is completely sealed off from water end. Anti-friction bearings are arranged to handle heavy loads. An example of Amsco's striving for the utmost in durability is the use of manganese steel, "the toughest steel known", for shells, impellers, sideplates and liners.

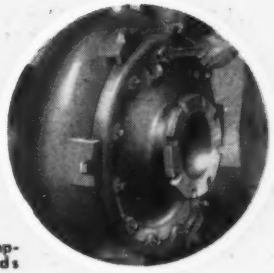


Figure 1—Clamping ring holds end plate.

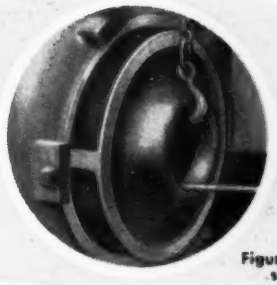


Figure 2—Impeller screws off.

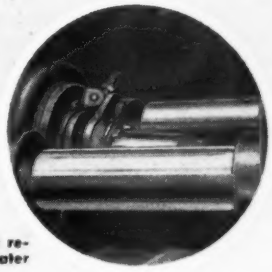


Figure 3—Easy removal of water end.

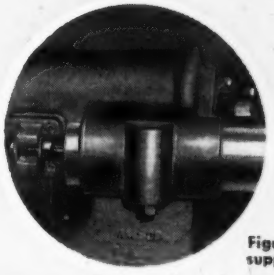


Figure 4—Tubular supports clamp in housing.

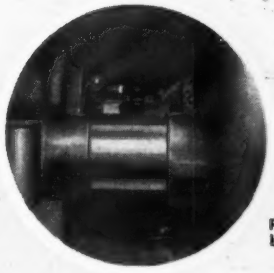
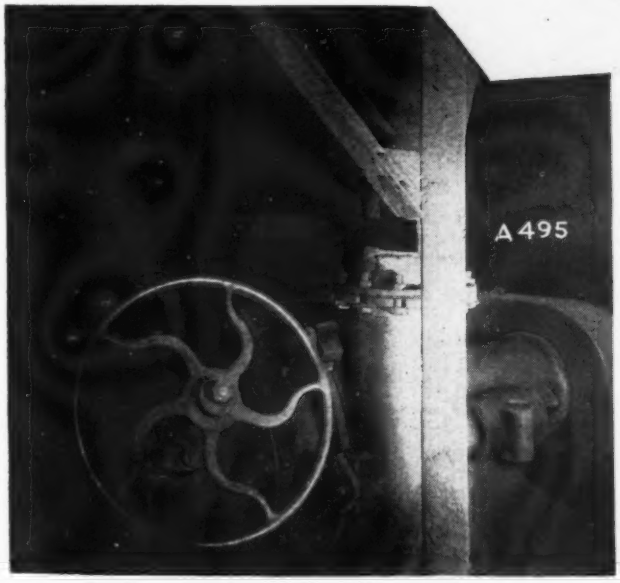


Figure 5—Accessible stuffing box.



Typical power plant installation of an Amsco-Nagle, 6", Type "T", Ash Handling Pump.

AMSCO-NAGLE PUMPS ARE EASIER TO MAINTAIN

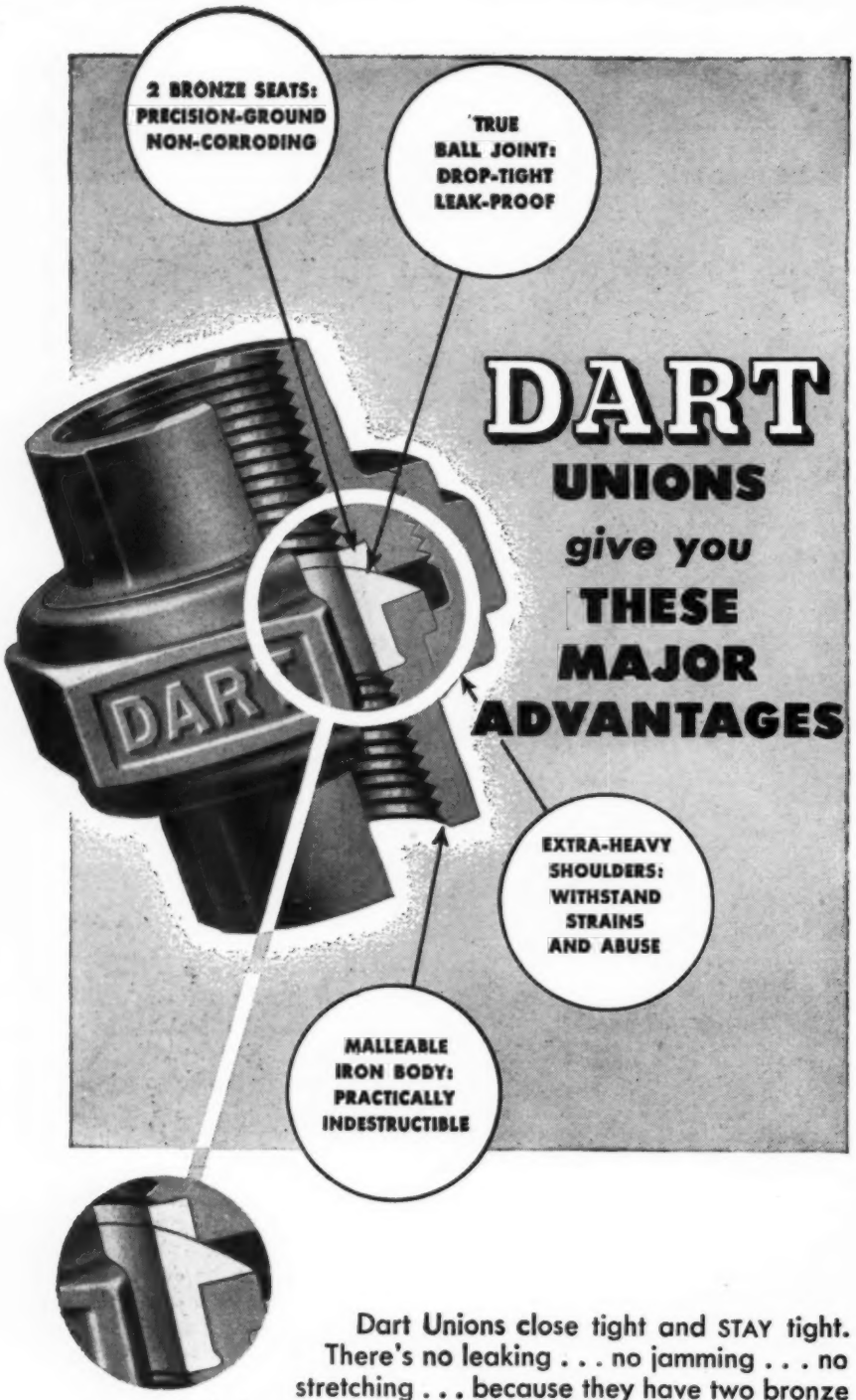
Water end parts subjected to wear can be adjusted or replaced easily and quickly. End plate comes off by simply removing clamping ring (clamping dogs on some models) — see Figure 1. Impeller screws off — see Figure 2. Or entire water end can be removed —see Figure 3. Tubes on casing clamp in bearing housing as shown in Figure 4— horizontal jack screw adjustment before tightening clamp bolts assures positive alignment of impeller in casing. Stuffing box readily accessible between tubes — see Figure 5.

Write for Bulletin describing these pumps.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILL.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo., Oakland, Calif., Los Angeles, Calif., St. Louis, Mo.
Offices in principal cities. In Canada: Joliette Steel Limited, Joliette, Que.



Dart Unions close tight and STAY tight. There's no leaking . . . no jamming . . . no stretching . . . because they have two bronze seats which form a true ball joint—all housed within a body of malleable iron that is practically indestructible. These major advantages give longer life and greater economy. They enable Darts to be uncoupled easily and used over and over again in different locations.

Your supplier will be glad to show you why Darts are a SOUND UNION INVESTMENT.

E. M. DART MFG. CO.

PROVIDENCE 5, RHODE ISLAND

DART UNIONS

American Welding Society announces winners of 1947 A F Davis Undergraduate Welding Award. John W Price Jr, of Rose Polytechnic Institute, Terre Haute, Ind., has been selected as winner of the $200 first prize and Howard Sanders, of Cornell University, Ithaca, N. Y., has been selected as winner of the $150 second prize. "Atomic-Hydrogen Arc Welding" was the subject of Price's paper, published in March 1947 issue of the *Rose Technic*. Sanders' article, "Welders in Diving Suits," appeared in the March 1947 issue of *The Cornell Engineer*. Each of these undergraduate magazines will also receive awards of $200 and $150, respectively, for printing the prize-winning articles. This event is sponsored by A F Davis, vice-president and secretary of Lincoln Electric Company.

Growing interest in newer and more convenient block and board forms of mineral-wool insulation has caused the government to issue purchasing specifications for Army, Navy, Maritime Commission and other government bureaus to use in buying insulation for heated surfaces. Industrial Mineral Wool Institute, which worked with the U. S. director of procurement in publicizing the specifications, points out that they are minimum specifications only and are well exceeded by present-day mineral-wool insulation producers. For maritime applications additional specifications are given for fire-retarding qualities, noncorrosive qualities in contact with steel plates, and bacteria and mold resistance under humid conditions. The new Federal Specifications *HH*-1-564 should also prove helpful to private purchasers. It is available from *Superintendent of Documents, Washington, D. C., at 5¢ per copy.*

A basic sound slide course, entitled *Radio Frequency Heating—Fundamentals and Applications,* is of special interest to plant engineers, metallurgists and technicians in heating fields. It is now being offered by Westinghouse Electric Corp in a series of eight 2-hr lecture units. Simple rule-of-thumb methods are outlined for determining how and when radio frequency heating can be practically and economically applied in industry. Lecture units cover metal-working applications like soldering, brazing, annealing and hardening by induction heating, as well as bonding of wood, preheating of plastics, drying and curing of rubber and textiles, thawing and deinfestation of food products by dielectric heating.

Complete course is furnished in a kit containing sufficient material for 20 class members. Included are a set of 15 slide films, a set of records to match, 20 sets of review booklets and quiz questions. An instructor's manual contains complete lecture outlines, quizzes, suggestions on presentation and over 200 pages of reference material. All quizzes are of the word-selection type requiring a minimum of the class member's time. Cost of the kit for 20 class members is $185. Sets of illustrated review booklets and quiz sheets for additional class members are $3 per set. Further information regarding the course may be had from *Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa.*

WHATEVER YOUR PIPING NEEDS

fills them quickly- dependably

KNOWN SINCE 1893 FOR HIGH-QUALITY

dependable **PIPING**

prefabrication and installation

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

President

BENJAMIN F. SHAW COMPANY — 2ND & LOMBARD STS., WILMINGTON 99, DEL.

STOP LIVE STEAM LOSS in Superheat Service

WITH

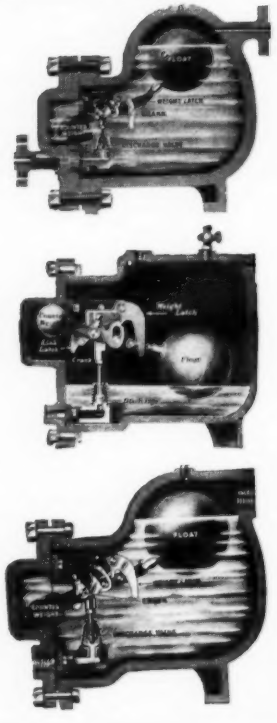
NICHOLSON

LEAK-PROOFED

→ *Weight-Operated Traps*

If you are losing live steam in your superheated service, because traps dry up and leak, Nicholson weight-operated traps offer a now widely adopted remedy. Though "cooked" dry, the valve of these traps holds tight due to their weight operation.

SUBSTANTIAL SAVINGS—Steam and fuel savings in substantial quantities are reported from installations of Nicholson weight-operated traps. 4 types; pressures to 1500 lbs. Stainless steel working parts.



Catalog 444 or see Sweet's

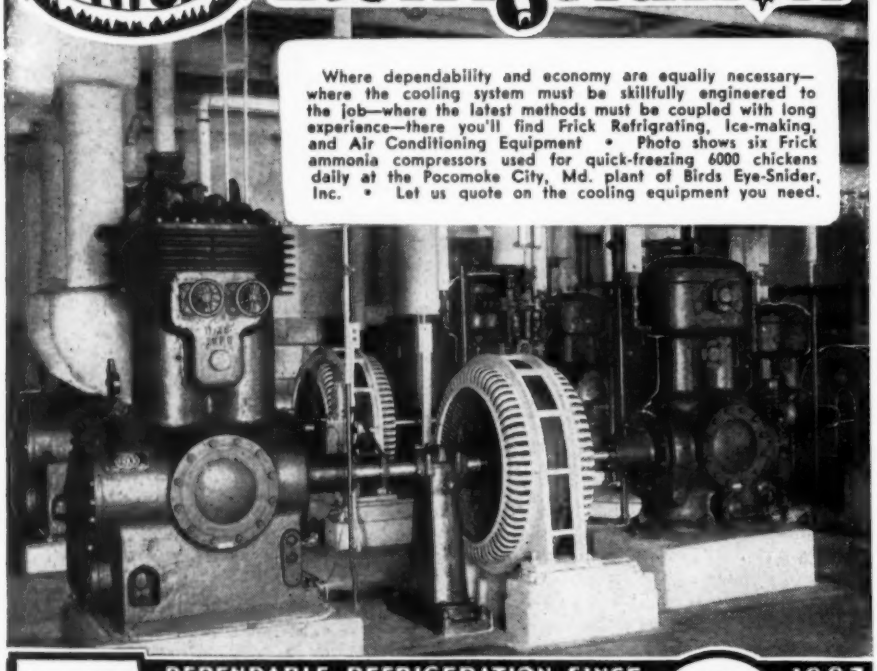
W. H. NICHOLSON & CO.

125 OREGON ST., WILKES-BARRE, PA.

Valves • Traps • Steam Specialties

TRADE FRICK MARK **Refrigeration**

Where dependability and economy are equally necessary—where the cooling system must be skillfully engineered to the job—where the latest methods must be coupled with long experience—there you'll find Frick Refrigrating, Ice-making, and Air Conditioning Equipment • Photo shows six Frick ammonia compressors used for quick-freezing 6000 chickens daily at the Pocomoke City, Md. plant of Birds Eye-Snider, Inc. • Let us quote on the cooling equipment you need.



DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

MEXICO, D. F.: Mexican Light & Power Co, largest private group in electricity production field in Mexico, will invest $1,875,000 during 1947 for improvement of its own plants and those of its subsidiaries. This program is only one phase of the general plan for electrification of Mexico over a period of years, under the general supervision of Ministry of National Economy, a plan intended to contribute considerably to development of Mexican industry in general.

During the years 1941 to 1946, inclusive, the money spent by the company for new plants, reconstruction work and additional equipment for its main plant at Necaxa totaled $86,700. In addition, installation of new transmission lines, modifications, replacements and additions to existing lines, improvement of worker camps, purchase of rights of way represented an expenditure of $232,200 during the same period. The distribution nets necessitated, also during the above period, an expenditure of $80,250, against which a sum of $367,600 will be invested in this field during the current year.

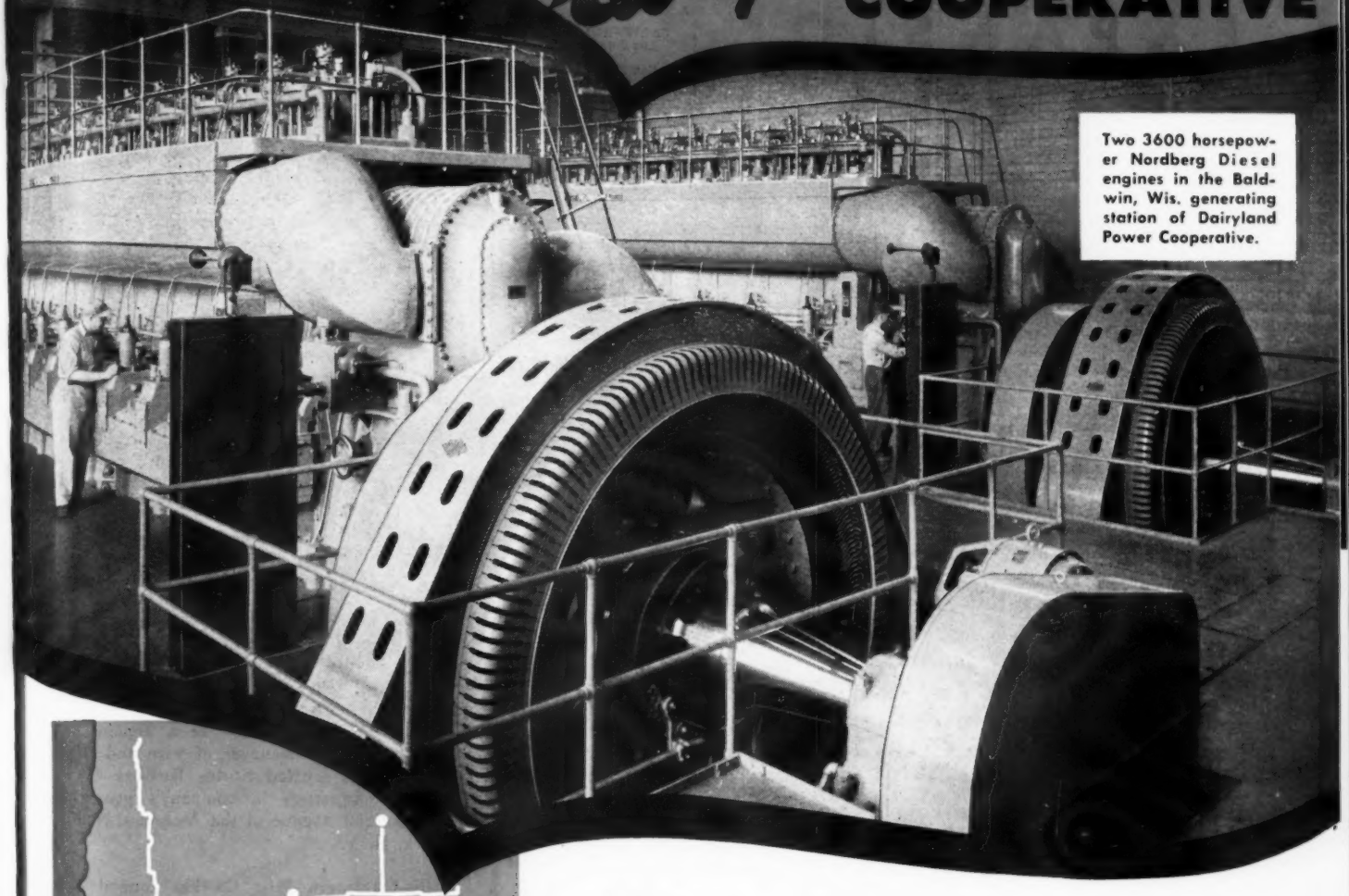
In all, including government investments in the electrical field, electrification works represented an investment of $2,888,700 for the 1941-1946 period, while in 1947 alone the national total will reach $1,875,000, or about 60% of total expenditure made during preceding 7-year period.

LONDON, ENGLAND: One or more gas-turbine-powered generators of 15,000-kw capacity may be ordered in the near future by Britain's Central Electricity to provide economical and flexible "booster" plant to cope with short-period peak loads. This step, foreshadowed in CEB's recently issued annual report, would greatly reduce the load-shedding that has been necessary during each of the past two winters.

MELBOURNE, AUSTRALIA: Cathode-ray tube as a power-frequency synchroscope has been developed and tested by State Electricity Commission of Victoria, Australia. Synchronizing equipment at each switching station helps to preserve continuity of power supply because connections can be remade at points of circuit interruption without de-energizing sections of the line back to the generating station. This synchroscope dispenses with the large number of potential transformers required for instrument connection on each side of each circuit breaker. The instrument uses the electrostatic potential in aerial conductors suspended adjacent to transmission lines. Although these conductors have been used to indicate whether lines are energized, the electronic synchroscope also uses them for reflection of phase relation of different transmission lines.

NORDBERG DIESEL POWER

for the *largest* POWER COOPERATIVE



Two 3600 horsepower Nordberg Diesel engines in the Baldwin, Wis. generating station of Dairyland Power Cooperative.

★ *Baldwin Plant*

THE Dairyland Power Cooperative furnishes electric service to twenty-five distribution cooperatives having more than 50,000 members located in the rich agricultural section of the Upper Mississippi Valley. Among the five generating stations which provide power to energize over 1,800 miles of main transmission line is the Baldwin, Wisconsin station where two Nordberg Diesels with a total of 7,200 horsepower are installed. These engines are used to carry peak loads, a type of service for which the Diesel is ideally adapted. Diesel units can be put on the line and under load quickly and when shut down there is no stand-by expense. Under the above peaking load operation, the Nordberg Diesels have averaged 14.31 K.W. hours per gallon of fuel since the engines have been placed in service.

If you are contemplating additional power equipment investigate the merits of Nordberg Diesel power.

NORDBERG MFG. CO., MILWAUKEE 7, WIS.

NORDBERG MACHINERY

NORDBERG

DIESEL ENGINES

NORDBERG MACHINERY

GET THIS ADSCO EXPANSION CALCULATOR FREE

Tells Traverse Needed in ADSCO EXPANSION JOINTS

● This time-saving slide rule quickly shows expansion per 100 ft. of pipe for various materials and temperatures.

1 Abbreviated steam table on calculator.

2 No computations necessary... no handbooks... no chance of errors.

3 Tells required traverse of slip.

4 Protects connected equipment.

5 Safeguards against piping strains... one of the greatest causes of leaks, steam losses and expensive repairs.

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North Tonawanda, N. Y.

Please send me an ADSCO Expansion Calculator without charge... also ADSCO Expansion Joint Bulletin 35-15PR.

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APPOINTMENTS

Link-Belt Co announces election of Robert C Becherer to plant manager of Ewart plant in Indianapolis. Warren H Maxwell has been appointed general superintendent. S L Houck becomes assistant general superintendent of Ewart plant. Carl O Schopp has been named superintendent of Ewart plant foundry. Company reestablished a sales office in Washington, D. C., at 1009 Washington Gas Light Bldg, with C R Heller, Washington representative, in charge. Heller's duties will be confined to work with foreign purchasing commissions and with governmental and armed service bureaus in Washington. Industrial sales in District of Columbia will continue to be handled by company's office in Baltimore. Franklin C Schimpf has been made controller of Link-Belt, with headquarters at 307 N Michigan Ave, Chicago.

E C Schum has been named district manager of **Nordberg Mfg Co.** His headquarters will be at Kansas City, Mo. He will take over territory formerly covered by late James Gallaway, which includes Mo., northern Ark., southern Iowa, Kan., Neb. and Colo. A new district office has been opened in Cotton Exchange Bldg, Dallas, Tex. This office will be headquarters for Charles Trimble, district manager, and Joseph T Adams, sales engineer.

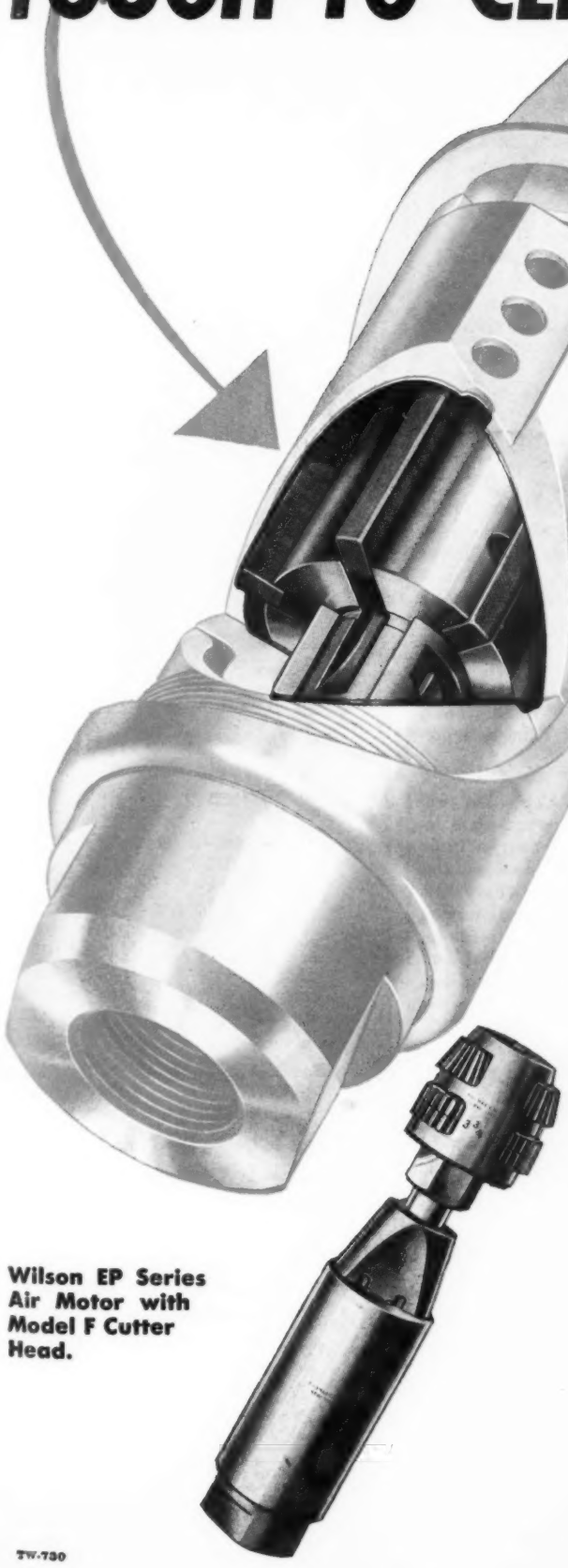
Babcock & Wilcox Co announces two administrative changes for its Barberton, Ohio, works. G J Hartnett Jr becomes superintendent of planning and M Nielsen superintendent of production.

Richard B Carland has been appointed sales promotion manager of wire and cable dept of **United States Rubber Co**, with headquarters in company's general offices, 1230 Avenue of the Americas, New York, N. Y.

Allis-Chalmers Mfg Co has formed a new turbo-power development dept in engineering development div. R C Allen has been named manager and chief engineer of the new dept. W A Yost succeeds Allen as manager of steam turbine dept. William A Roberts and William C Johnson have been appointed executive vice-presidents, respectively, of tractor and general machinery divisions. Marshal L Noel is now vice-president and general sales manager for tractor div and J L Singleton vice-president and director of sales for general machinery div. Karl J Ratliff has been appointed resident representative for general machinery div at Fort Worth, Tex. H B Walters has been named works manager of company's Boston works. J H Burrus has become assistant manager of Portland district office. F V Sams continues as manager of this office.

Responsibility for **General Electric Co** policy on employe relations has been assigned to L R Boulware, vice-president. E D Spicer will be in charge of manufacturing policy, continuing as a member of president's staff. Responsibility for activities of affiliated manufacturing companies, relinquished by Boulware, has temporarily

Show this motor your TOUGH-TO-CLEAN TUBES



Wilson EP Series Air Motor with Model F Cutter Head.

Bring on your clogged up tubes with the heavy deposits and sticky scale!

Tough-to-clean tubes are "duck soup" for this extra powerful Wilson EP Series motor. Size for size, it generates *up to 40% more power*—on the curves or in the straightaway—than ordinary motors. It drives through heavy deposits without stalling or slipping.

Yes, after years of proven performance, this same Wilson EP Series motor still leads the field for power, speed and economy.

The secret of these extras in power, speed and economy? It's in the six-bladed, light-bladed construction. With the EP motor you get higher torque at any speed because six blades produce a smoother flow of power . . . 12 powerful impulses per revolution. Light blades eliminate the need for expensive cylinder replacement. Automatic valving of operating air means less air-consumption . . . a minimum of back pressure. Its six blades eliminate "dead" center . . . make it easy to start—hard to stall. Why not see your local Wilson Representative about cost cutting EP Motors today?

THOMAS C. WILSON, INC.
21-11 44th Avenue, Long Island City 1, N. Y.
Cable Address: "TUBECLEAN", New York

WILSON
TUBE CLEANERS

TW-730

CHECK the advantages of XZIT Firescale and Soot Eradicator

☐ From firebox to top of stack XZIT cleans out soot and firescale.

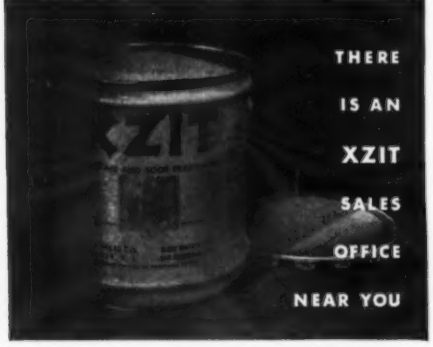
☐ XZIT does its work while boilers operate.

☐ XZIT can be used to extinguish stack fires and to stop sparking.

☐ Stack temperatures definitely prove that XZIT improves heat transfer, increases boiler efficiency.

☐ Used regularly, XZIT keeps boilers free of soot and scale—chipping and scraping are seldom necessary.

☐ Stocks are available in all localities—order a trial supply.



XZIT

FIRESCALE & SOOT ERADICATOR

5800 S. Hoover St., Los Angeles, Calif.

158 14th St., Hoboken, New Jersey

been assigned to Ralph J Cordiner, vice-president and assistant to the president. Clarence W Coe has been appointed manager of new Decatur, Ill., works of plastics div. Coe had been manager of div's plant at Ft. Wayne, Ind., operation of which will be transferred to Decatur.

General Electric Co announces that T A Worcester, assistant manager of central stations divisions, has retired after 42 years of service with the company. S B Crary and W J McLachlan have been made assistant managers. John A McManus, for many years secretary to the late Prof Elihu Thomson, famous scientist and inventor, has retired from active service with General Electric Co, Lynn, Mass. McManus joined the company in 1896. Frederick J Rudd, managing engineer of motor div of River works at Lynn, Mass., since 1932, and an employe for 46 years, retired from active service July 1. L R Brown, manager of transformer divisions, has retired after 44 years of service.

H C Wallace has been appointed manager of **Air Reduction's** Louisville district, which covers Ky., Tenn. and part of Ind. His headquarters will be at district sales office in Louisville. Wallace succeeds R S Moore, recently deceased. Air Reduction opened a new oxygen plant in Decatur, Ill. George H Klingenberg was named superintendent of the new plant. A new oxygen manufacturing plant was opened at Baton Rouge, La. J L West has been made plant superintendent.

Combustion Engineering Co announced opening of offices at 2140 Rand Tower, Minneapolis, with Frank J Palm as representative in charge.

Westinghouse Electric Corp has appointed T O Armstrong director, plant labor relations. He will be located in Pittsburgh office. Electronics engineering and electronics sales activities for Buffalo divisions will be handled by two newly formed sections. The changes are being made in connection with transfer of industrial control div from East Pittsburgh, Pa., to Buffalo, N. Y. E H Vedder is named manager of electronic control engineering section and R W Staggs is appointed manager of electronic control sales section. Staggs will also be responsible for sales activities of resistance welding control. C B Stadum was made manager of resistance welding engineering section and W G Roman manager of electronic section—a combination of previous Mototrol and electronic regulator sections. Both will report to Vedder.

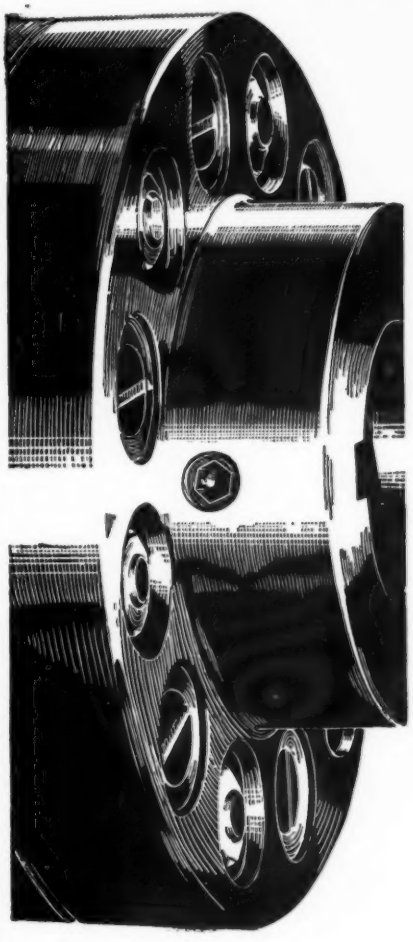
Walter Kidde & Co elected Paul W Eberhardt to board of directors.

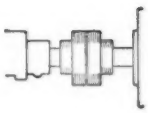
Louis D Striebel has become manager of Michigan City plant of **C A Dunham Co.**

Hugh J Fraser, vice-president of **International Nickel Co,** has been placed in general charge of all plant operations of the company in U. S. John A Marsh has been appointed Fraser's assistant, with title of assistant to vice-president. His office will be in New York City. Joseph M

AJAX

FLEXIBLE COUPLINGS





Safeguard your direct-connected machines against unavoidable misalignment with the positive, resilient drive of Ajax Flexible Couplings. Write for Data Book.

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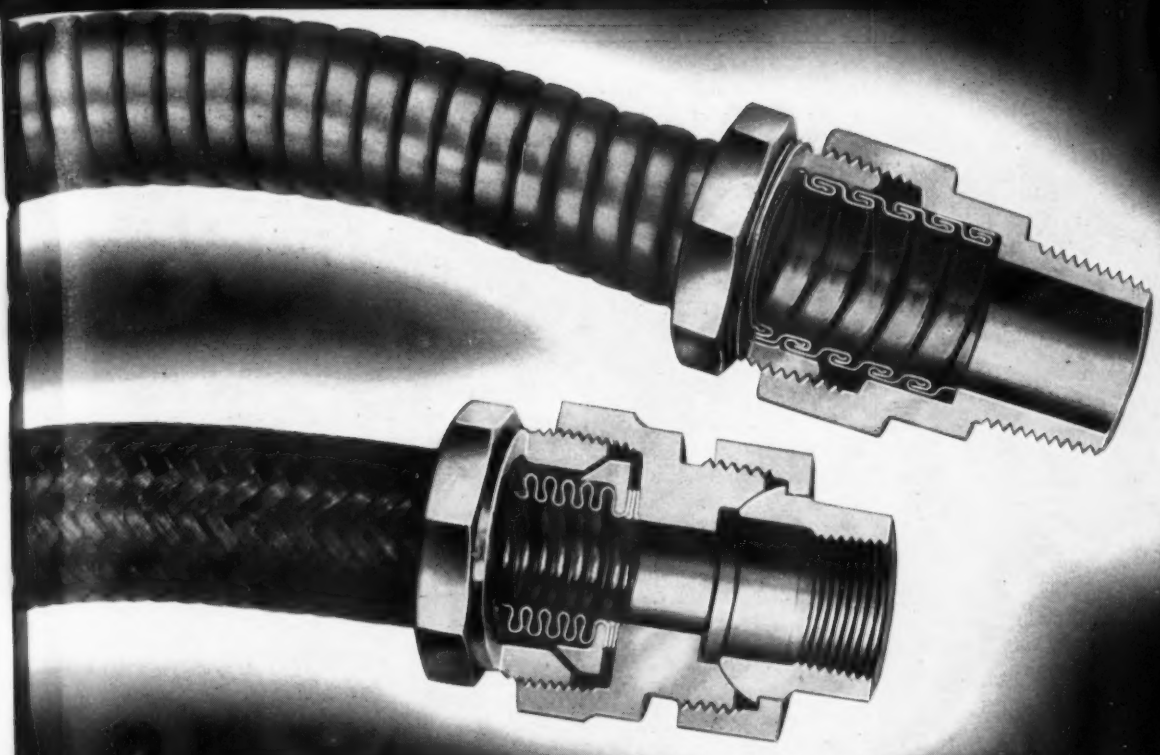


TWO RUGGED INDIVIDUALISTS"

Live steam under pressure is a tough medium to handle. It can cause a bad cycle of troubles when it breaks loose.

But daily — in a variety of services and machines — the two types of American Flexible Metal Steam Hose, illustrated above, handle the problem with ease. Both are successful because they are so well constructed of strong metal, yet have practical flexibility.

The type illustrated at the top of the page is constructed of bronze metal strip so formed as to interlock, giving a four-wall metal-to-metal joint, made pressure-tight by asbestos cord packing. Made of bronze — this hose, known as American Type BD-15, is highly resistant to corrosion, moisture, high temperature and pressure. It is a rugged hose, especially adapted to steam service where rough handling is encountered.

The other type illustrated is made from seamless tubing with no seams, laps, welds or joints of any kind. Corrugated for flexibility and covered with one or more wire braids actually woven over the corrugated tubing to give added strength, it is thoroughly dependable for use under high pressure. American Seamless Flexible Metal Tubing is used where 100% tightness plus extreme flexibility is needed to connect moving parts of machinery, absorb vibration in pipe lines or facilitate piping installations in cramped spaces.

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

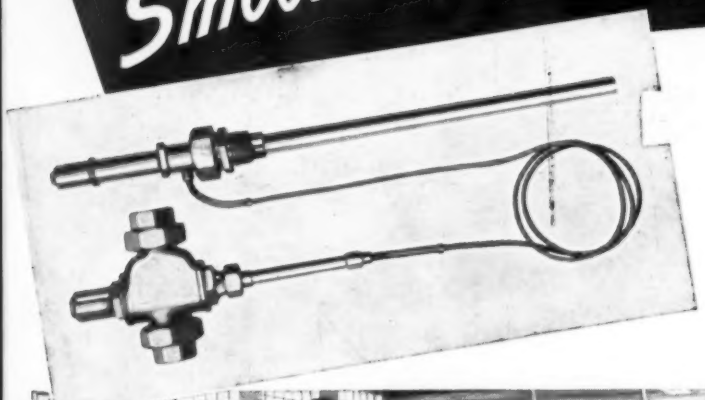
General Offices: Waterbury, Conn. • Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

TURN PAGE FOR OTHER FLEXIBLE METAL HOSE APPLICATIONS

For Better Methods and Smoother Performance

AMERICAN *Flexible* METAL HOSE & TUBING

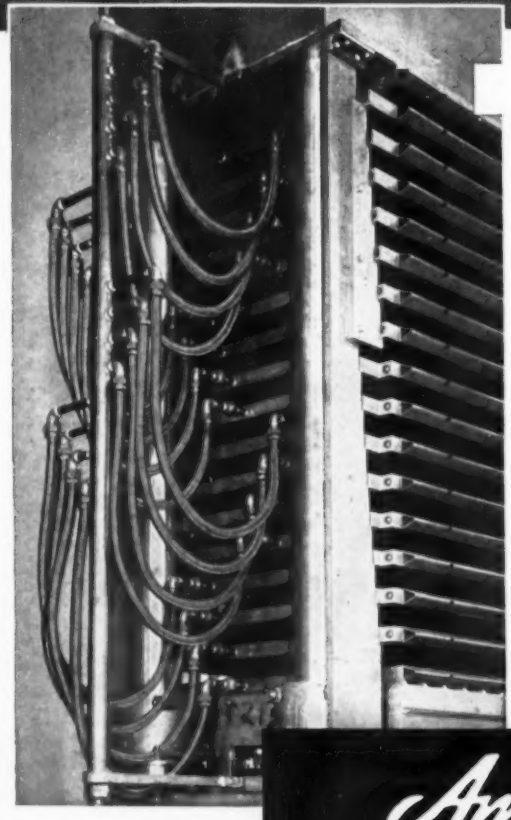


. . for Protecting Delicate Tubing

The delicate capillary tubing on this modern temperature regulator could be easily damaged, were it not for the American Flexible Metal Hose which serves as a protective casing between the thermostat and the valve — insuring safe, continuous operation of the control regulator.

. . for Carrying off Exhaust Gases

Modern garages now have an efficient method of exhausting fatal carbon monoxide gas from closed areas, especially in winter. They use asbestos packed interlocked American Flexible Steel Hose which is easily handled and 100% effective. Being flexible, American Metal Hose does not require exact parking for connecting hose to tail piece. Quickly attached, the result is a "safety path" for deadly gas into a suction system which expels it outside the garage.



. . for Conveying Hot Liquids

Here American Seamless Flexible Bronze Tubing with bronze wire braid covering conveys hot water under pressure to provide heat in the bonding of plywood. This press is a fifteen-opening hot plate press with a capacity of 925 tons — a good example of how American Seamless is used for connecting moving parts of heavy machinery.

As an original installation, American Flexible Metal Hose and Tubing pays dividends "right from the start": easily and quickly assembled; absolutely tight and dependable; sufficiently flexible to provide for slight lineal contraction and expansion; reduces the noise and danger of vibration; requires little or no maintenance attention.

For further information write for literature. Please ask for the advice of our Technical Department on unusual problems.

47288

ANACONDA

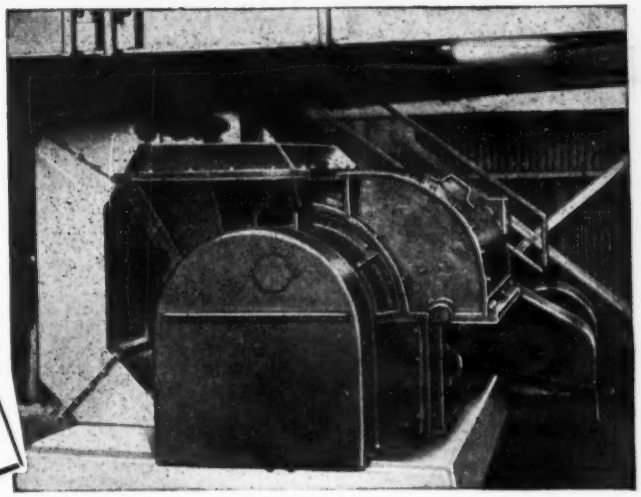
American Metal Hose

THE AMERICAN BRASS COMPANY — AMERICAN METAL HOSE BRANCH

General Offices: Waterbury, Conn. • Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

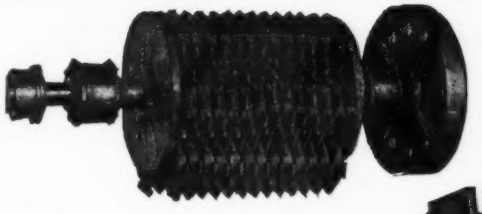
for a low cost coal crushing operation that's COMPACT AND COMPLETE



AMERICAN ROLLING RING CRUSHERS

—installed in minimum headroom as a complete high capacity coal preparation plant

COAL IS SPLIT · NOT CRUSHED



Illustrations show America's exclusive manganese steel shredder ring and rotor assembly. Each shredder ring has 20 cutting edges. The high tonnage output of Americans at slow power-saving speeds is attained by the rapid reducing action of the multiple cutting edges of the rows of rings on the rotor as shown above.

The compactness of design and construction of American Type "S" Rolling Ring Crushers makes for a complete, high tonnage installation in minimum headroom requirements. No auxiliary crushing operations and equipment are necessary to the high performance of Americans—no extra picking and standby-cleanout labor is required.

An American Rolling Ring Crusher creates no refuse problem. Uniformly reduces ROM coal to stoker or pulverizer sizes—handling slate and pyrites and rejecting tramp iron—safeguarding against passing of large, non-crushable pieces.

There's an American to fit your operation. Capacities from 25 to 500 TPH.

The cross section at left shows American compactness of design and the exclusive shredder ring principle. Revolving on their individual shafts, the shredder rings deflect without damage from tramp iron. The crushing chamber is made up of sectional manganese steel liners. Housings are of heavy ribbed steel castings secured at dust-tight machined joints with coupling bolts. This makes for easy access to all crushing parts.

Send for bulletin: "Crushing Coal for Less Than 1c per Ton."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1429 Macklind Ave.
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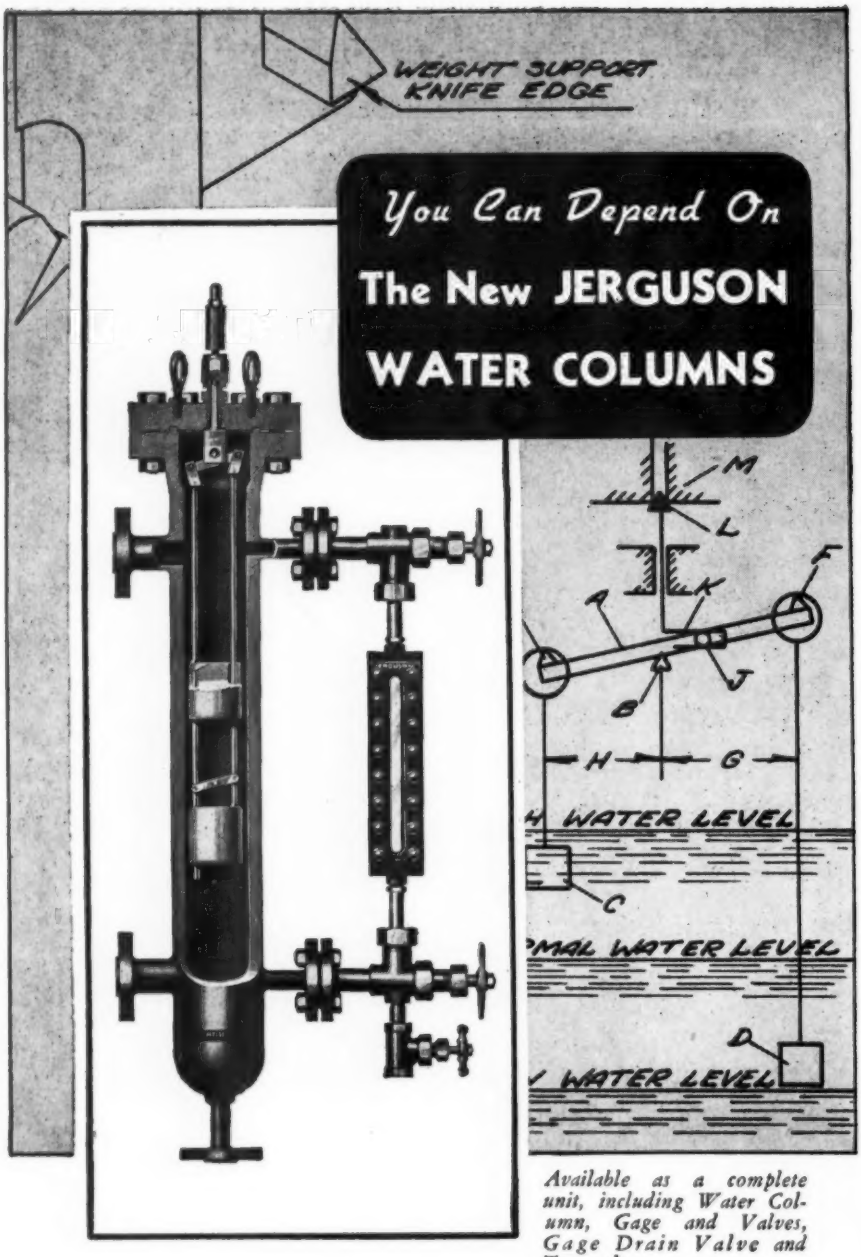

Available as a complete unit, including Water Column, Gage and Valves, Gage Drain Valve and Try-cocks.

YOU can depend on the New Jerguson Water Columns for positive low water and high water alarm and for long, trouble-free service . . . for they are skillfully engineered and built. New dependability is built into these water columns with a unique alarm mechanism with weights supported on hardened, stainless steel knife-edges. Alarm mechanism is stainless steel throughout; valve stem, cam and knife-edges are carefully hardened.

Jerguson Water Columns are available in a complete range of pressures and sizes and a variety of styles, with screwed or flanged connections.

Write For Engineering Data Unit

JERGUSON

GAGE & VALVE COMPANY

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Representatives in Major Cities . . . Phone Listed Under JERGUSON

Weldon has been named assistant to vice-president. He will be assistant to H J French, vice-president.

H K Porter Co has promoted Harold A Hintz to Pacific Coast sales manager. Hintz will direct activities of all Porter sales offices on Pacific Coast and will maintain headquarters in Petroleum Bldg, Los Angeles. J F Morley has been appointed district sales engineer, with offices in Monadnock Bldg., San Francisco.

G L Pike, 10 Winnemere St, Malden 4, Mass., has been named sales representative by **Gibson Electric Co.** His territory covers all of the New England states.

All-State Welding Alloys Co has appointed Richard T Spear regional sales manager for line of low-temperature welding and brazing alloys and fluxes. His territory includes eastern Pa., southern N. J., Va., W. Va., Dela., Md., and District of Columbia.

Ralph V Davies, Robert B McKee and Donovan Wilmot have been promoted to vice-presidents of **Aluminum Co of America.** Davies will also become general sales manager for Alcoa, succeeding George J Stanley, who retired July 1. Stanley will continue as a director of the company.

J M Graham Jr has been promoted to general engineering dept of **Monsanto Chemical Co** as manager of process section and H T Gammon has returned to his former post as manager of project analysis section. Harvey M Harker has been made general branch manager for new sales office at Houston for state of Tex. Kenneth O'Connor will be in charge of office operation at this new sales office. John R Eck has been named plant manager of Trenton, Mich., plant. James A Wilson has been made plant manager at Everett, Mass. John S Hayes has been appointed div engineer for Merrimac div, which has headquarters at Everett. David H Parshley was named assistant to plant manager at Everett. Russell L Miller and Harold N Stevens were made superintendents at Everett. George Odom will continue as superintendent. Ivan V Wilson has been made assistant director of research, and Arthur L Gardner assistant to div general manager of Merrimac div at Everett. Gardner will deal primarily with production problems.

Dr Charles Allen Thomas of St. Louis, vice-president and technical director of **Monsanto Chemical Co,** was elected executive vice-president. Felix N Williams of Springfield, vice-president and general manager of plastics div, was elected to board of directors. Five additional vice-presidents were elected by the board: (1) Josiah B Rutter of Everett, Mass., general manager of Merrimac div, (2) Dr C A Hochwalt of Dayton, director of central research dept, (3) William W Schneider of St. Louis, secretary of the company and head of legal dept, (4) Daniel M Sheehan of St. Louis, comptroller, (5) C A Wolfe of St. Louis, director of purchases and

For Permanently Tight Joints

Easy to Apply!

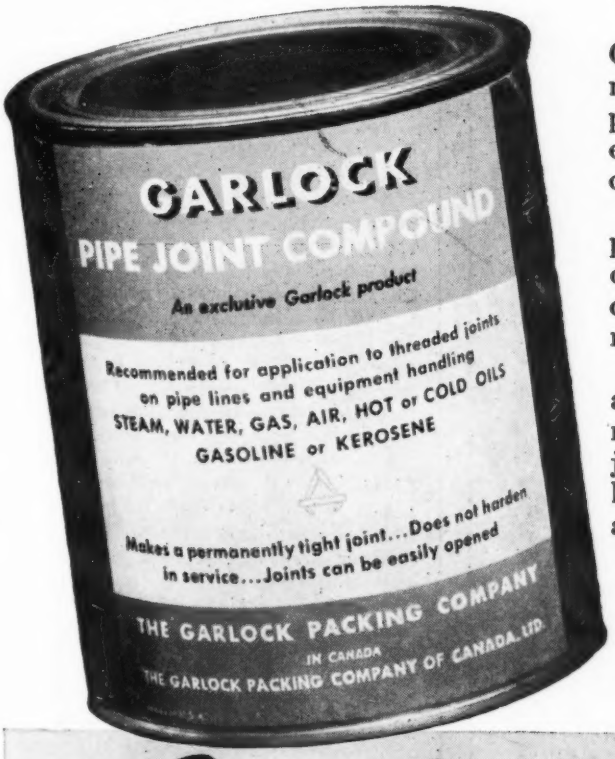
Does Not Harden or Shrink

Keeps Joint from "Freezing"

Protects Against Rust and Corrosion

Does Not Drip

Does Not Spoil or Deteriorate


GARLOCK
PIPE JOINT COMPOUND
An exclusive Garlock product
Recommended for application to threaded joints on pipe lines and equipment handling
STEAM, WATER, GAS, AIR, HOT or COLD OILS
GASOLINE or KEROSENE
Makes a permanently tight joint... Does not harden in service... Joints can be easily opened
THE GARLOCK PACKING COMPANY
IN CANADA
THE GARLOCK PACKING COMPANY OF CANADA, LTD.

Particularly Effective

on joints subject to Vibration, Expansion or Contraction

GARLOCK Pipe Thread Compound is a superior material developed in the Garlock laboratories for application to threaded joints of pipe lines and other equipment handling steam, water, gas, air, hot or cold oil, gasoline, kerosene or alcohol.

You can depend on GARLOCK Pipe Thread Compound to make a permanently tight joint even under difficult conditions, as it will not harden, shrink or corrode. In fact, it protects joints against corrosion, rust and "freezing."

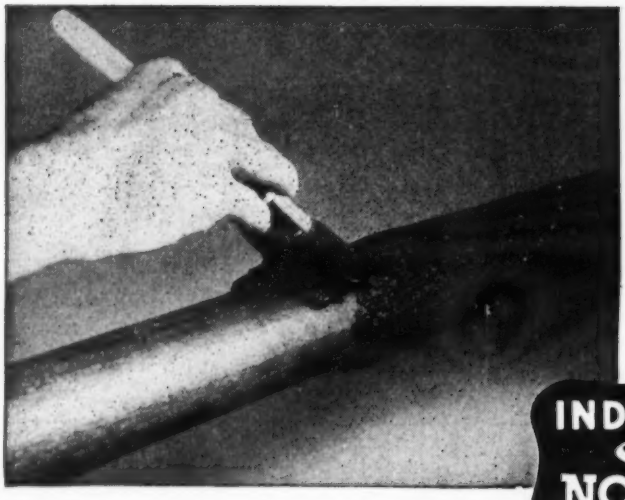
GARLOCK Pipe Thread Compound, ready to apply as it comes from the can, is handy to use and is economical—only a thin coating is required to make a joint. Does not spoil or deteriorate if kept in stock for long periods of time. Available in 2-lb., 4-lb. tin cans and in larger containers.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

60th Anniversary 1887-1947

Garlock PIPE THREAD COMPOUND



COVER PIPES, TANKS, WALLS, *with*

INDUSTRIAL NoDrip

Anyone can brush, trowel or spray NoDrip on any clean, dry surface. Goes on like plaster, forms a seamless, protective coating which effectively ***stops condensation drip.***

NoDrip keeps equipment and floors safe and dry; prevents corrosion of metal and prolongs its life. Acid, alkali and brine resistant. Comes in 1, 5 and 55 gallon drums, ready for use.

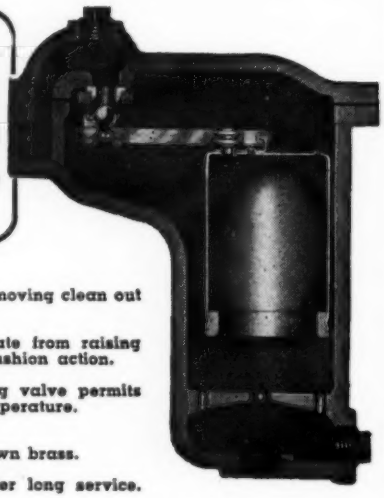
TRY NoDrip

Apply NoDrip to a small area, compare the results with uncovered portions.

Send for Free NoDrip Handbook

J. W. MORTELL CO. 549 Burch St., Kankakee, Ill.

10 REASONS TRAP USERS PREFER THE "CRYER"



1. Sediment chamber can be cleaned by removing clean out plug and flushing.
2. Baffle plate prevents slugs of condensate from raising bucket prematurely, thus providing a cushion action.
3. Stainless steel mechanical quick venting valve permits rapid discharge of air regardless of temperature.
4. Strongly constructed bucket of hard drawn brass.
5. Stainless steel seat easily removed after long service. No threads on seat.
6. Bronze fulcrum, holding seat in position, can be easily removed.
7. Free turning hard stainless steel rolling ball assures correct seating at all times.
8. Bronze test plug easily removed, permitting check up on operation without disconnecting piping.
9. Cover plate and all operating mechanism easily removed without disconnecting pipe.
10. Easily installed.

Sizes ½" to 2½"
Capacities 500 to 38,000 lb. of water
Pressures to 250 lbs.

Also Thermostatic Radiator Traps, as well as all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

Write for complete information.

CRYER TRAP AND VALVE CO., INC.

366 MADISON AVE. NEW YORK 17, N. Y.

Manufacturers of steam specialties for more than forty years

traffic. Frank Reese has been named to lead research mechanical-development group at Springfield. He is being replaced as group leader in charge of pilot plant operation by Eli Perry. Dr Joseph J Burbage has been promoted to assistant laboratory director of Units 3, 4 and 5 of central research dept. These are the units at Dayton and nearby Miamisburg, Ohio. Hart U Fisher, instrumentation engineer, has been transferred to central research dept in Dayton. Fisher will be in charge of instrumentation project.

Sterling, Inc, is now under new management. Paul A West will direct sales along with his duties as president. John B Ballard is named vice-president in charge of manufacturing.

Milton L Gearing, new general manager of New Departure Div of **General Motors Corp,** has announced his general staff for administration of affairs in the three plants where New Departure ball bearings are manufactured—Bristol and Meriden, Conn., and Sandusky, Ohio. All general officers listed below will make their headquarters at main plant at Bristol: (1) F W Marschner has been named administrative assistant. (2) George A Smith has been made general manufacturing manager. (3) Edward E Gill was reappointed general production manager. (4) Seth H Stoner became acting chief engineer during illness of T C Delaval-Crow. (5) Robert E Young has been named director of inspection. (6) Joseph A Ashwell was reappointed as director of purchases. (7) L G Sigourney was reappointed general sales manager. (8) Robert T Collins was made director of personnel.

Seth H Stoner, acting divisional chief engineer of New Departure Div of **General Motors Corp,** announced following staff appointments: (1) John H Baninger was reappointed assistant chief engineer. (2) Frederick J Garbarino became manager of bearing applications. (3) Leland D Cobb was made manager of research and development. (4) S Robert Large was made bearing products engineer. (5) Salvatore F Marino was appointed bicycle products engineer.

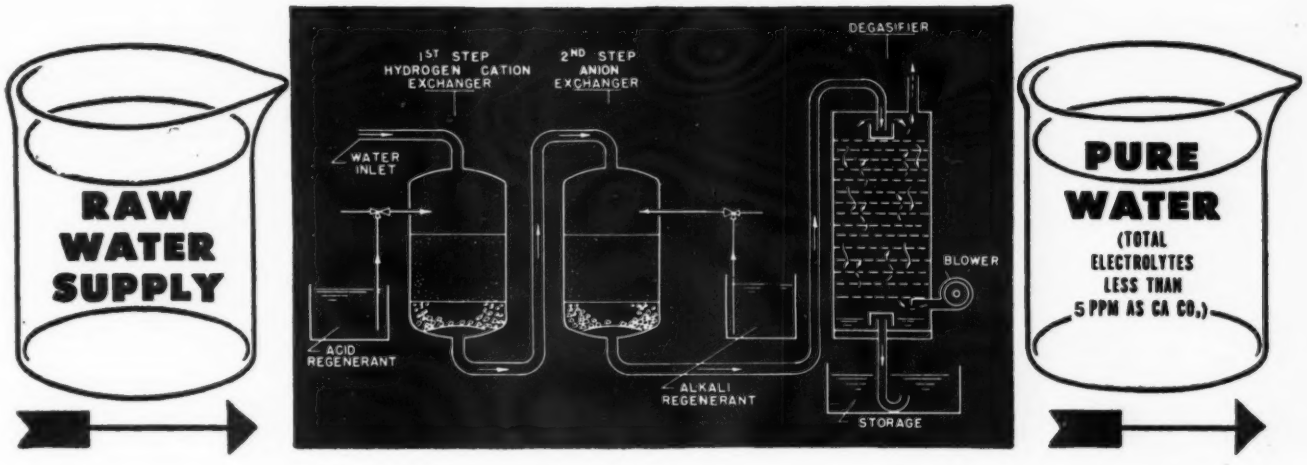
Laclede-Christy Clay Products Co has named N C Michels chief engineer. E H Krautheim has been made assistant chief engineer in charge of plant engineering and maintenance, and Les Mueller assistant chief engineer of arch and wall div. Herman W Weber has been added to executive staff as consulting engineer.

John A Worthington has been appointed general sales manager of piston ring div of **Koppers Co.** T Latimer Ford will head up a new dept devoted exclusively to replacement sales.

Leslie Co announces appointment by two of its district agents of following subagents to handle industrial sales and service: (1) By William P Little, Bridgeport, Conn.—Sherwood Bishop Co, 413 Woodland St, Hartford, Conn., as special

LIQUON

DEMINERALIZING PROCESS



SIMPLE...RELIABLE...ECONOMICAL

For boiler feed . . . for process work . . . for laboratory use . . . investigate the LIQUON Demineralizing process to obtain purer water at lower cost. Write for Catalog G, and your request for complete information will not involve the slightest obligation.

"DEMINERALIZE" . . . *to remove minerals* . . . that's exactly what the LIQUON Demineralizing Process does to your raw water supply. This process eliminates both hardness and alkalinity, and reduces the total dissolved solids down to practically zero. The result . . . the equivalent of most distilled water, and at a fraction of the cost of distillation.

HOW THE LIQUON DEMINERALIZING PROCESS OPERATES

In this two-step process, the raw water passes first through a LIQUON Hydrogen Zeolite Unit. Here, the salts present are converted into their corresponding mineral acids as the water flows through a bed of acid-regenerated LIQUONEX CR, a resin type of cation exchange material. The effluent from this stage then passes through a LIQUON Anion Exchange Unit, where the mineral acids are removed by the alkali-regenerated LIQUONEX A, a high-capacity anion exchange resin. Carbonic acid (carbon dioxide) is then removed by aeration in a LIQUON Degasifier or Decarbonator. Silica may also be removed where desired by adding fluorides or by a third step anion unit. The process is simple . . . the equipment is compact . . . the operating cost is frequently far less than one-tenth the cost of distilling water.

LC-120

LIQUID CONDITIONING CORPORATION

114 East Price Street, Linden, N. J. • *Engineering Service Representatives in Principal Cities*

Liquon

EVERY PROCESS...EVERY TYPE OF EQUIPMENT
for Conditioning of Water and Other Liquids

Fast Way to Improve Cooling Performance

DON'T let troublesome lime scale deposits hinder cooling efficiency and increase the cost of transferring heat in such equipment as:

- **mercury arc rectifiers**
- **power transformers**
- **voltage regulators**

Periodically descale coils of these water-cooled units with Oakite Compound No. 32, the safe, inhibited-acid descalant. The Oakite Service Engineer near you will gladly recommend the most efficient Oakite technique for your work. Whether he suggests pump circulation of solution, soak or tank-immersion descaling, you can be certain that the rapid scale-dissolving action of Oakite Compound No. 32 will restore equipment to the line in peak operating condition. And do it in cost-saving time! Arrange for his *free* service TODAY! Or write direct for 20-page helpful Oakite guide to lower-cost power plant maintenance. No obligation, of course.

OAKITE PRODUCTS, INC.
23 Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives Located in Principal Cities of United States and Canada

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REG. U. S. PAT. OFF.

Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

agent covering northern Conn. (2) By John H Marvin Co, Seattle, Wash.—Harold W Frederick Co, N 213 Division St., Spokane, Wash., to cover eastern Wash.

J H Bell has been appointed sales manager of **Foster Wheeler Corp's** newly created Dallas district. Bell will make his headquarters in Dallas. He will be in charge of a district that embraces parts of Tex., Okla., Miss. and all of Ark.

Alloy Steel Products Co has named E H Vockrodt, 3757 Wilshire Blvd, Los Angeles 5, Calif., Pacific Coast representative.

Ward Raymond, president of **Pennsylvania Pump & Compressor Co,** has resigned and is succeeded by Ellis R Snovel, former vice-president.

J A Zurn Mfg Co announces appointment of Albert A Sterling Jr as district engineer, with headquarters in Houston, Tex.

Thomas G Hart has been named general sales manager of **Whiton Machine Co,** New London, Conn.

Vulcan Soot Blower Corp announces appointment of Illes and Larkin, Cleveland, Ohio; Hebert & Co, Rochester, N.Y.; and Hawkins-Hamilton Co, Richmond, Va.; as sales engineering representatives in their respective territories.

Calco chemical div, **American Cyanamid Co,** has named Kenneth H Klipstein assistant general manager in charge of development dept and V E Atkins manager of manufacturing. Ames B Hettrick has been made assistant manager of manufacturing. L M Phelps will assume post of plant production manager, Bound Brook plant, formerly held by Atkins. F W Zipf was named assistant to manager of production. Alden R Loosli has been appointed assistant sales manager of rubber chemicals dept.

Champion Coal Co, an affiliate of Consolidation Coal Co, has accepted a franchise to sell and install Winkler stokers in Pittsburgh area. Stoker sales office is located at 409 Wood St. Winkler stokers are manufactured by U. S. Machine Corp.

Robert G Cady has been appointed manager of materials handling div of **Ajax Flexible Coupling Co,** Westfield, N. Y.

John Waldron Corp announces election of Thomas H Latimer as executive engineer in charge of engineering, drafting and estimating.

New branch plant of **Timken Roller Bearing Co** was opened in St. Thomas, Ont., Canada. The supervisory list includes: (1) John Jolly, general manager (2) Charles Wynn, assistant general manager (3) Jack McGinnis, production superintendent (4) Leonard Lewis, personnel director (5) C J Nickleson, auditor (6) Vaughn Courrier, works engineer (7) John Trull, purchasing agent (8) Frank Whatmore, planning superintendent (9)

Economize WITH POWERS

TEMPERATURE REGULATORS

Use a Powers No. 11 Temperature Indicating Regulator when you want the advantages of an easy-to-read dial thermometer combined with a dependable self-operating regulator. The dial thermometer gives a visual check on the performance of the regulator and makes it easy to adjust for the required operating temperature. Various dials and ranges are available.

Is Easy To Install—because both the thermometer and the regulator operate from the same thermal system—only one tapped opening is required.

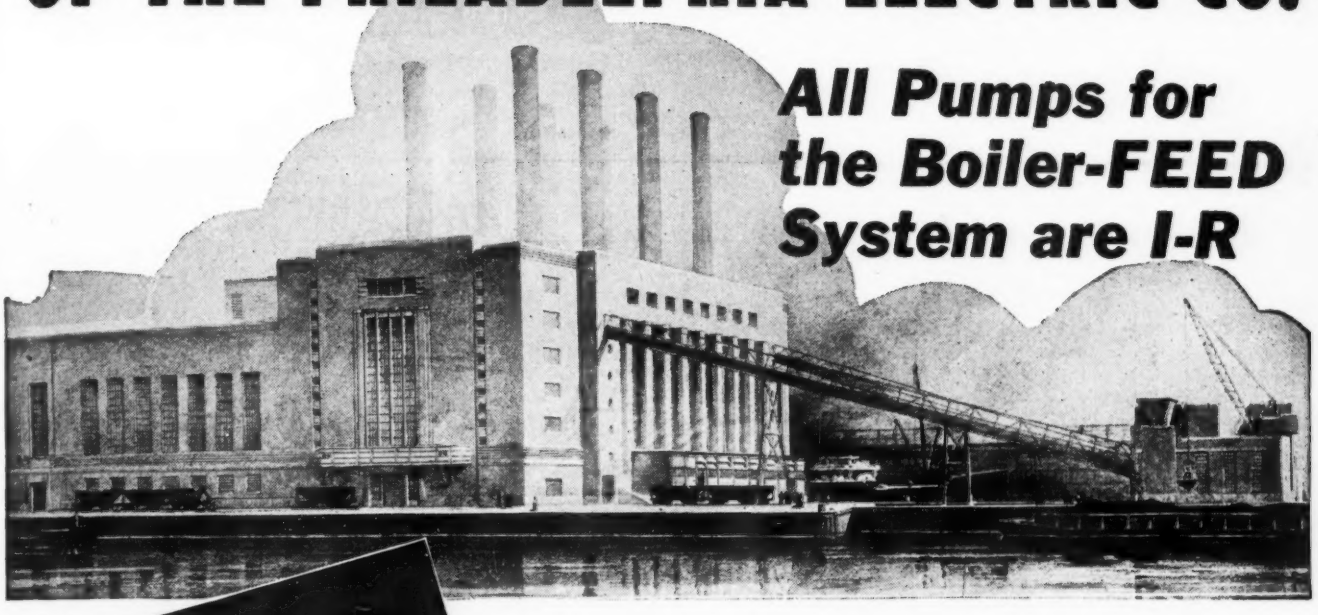
Write for Circular 2511

THE POWERS REGULATOR CO.
2717 Greenview Avenue, Chicago 14, Illinois
231 E. 46th St., New York 17, N. Y.—Offices In 47 Cities . . . See your phone directory.
70

OVER 50 YEARS
OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL

AT THE NEW SOUTHWARK STATION OF THE PHILADELPHIA ELECTRIC CO.

All Pumps for the Boiler-FEED System are I-R



18 PUMPS TOTALING 15,150 HP

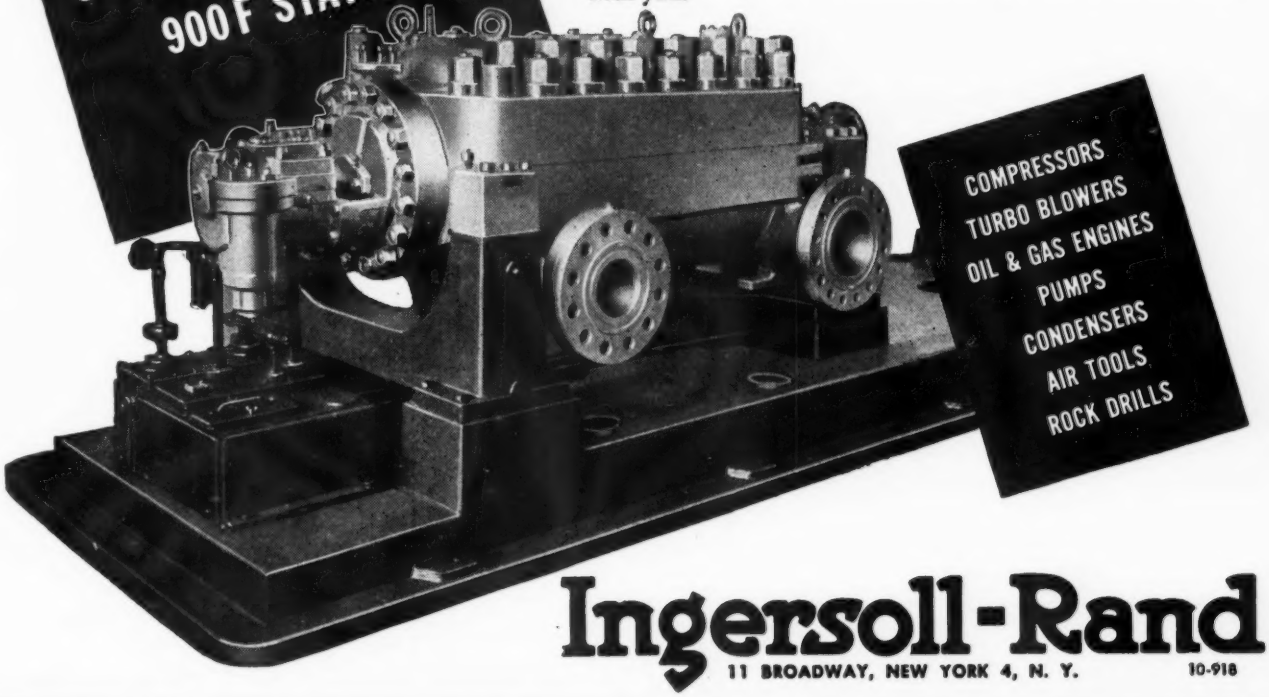
Serve

300,000 KW, 850 PSI, 900 F STATION

The six high-pressure feed pumps are 2400 gpm, 770 psi total head (discharge pressure approximately 1275 psi), 7-stage units operating at 1750 rpm.... Low pressure units of the same general design are each 2000 gpm, 550 psi total head, 5-stage, 1750 rpm....The six vertical condensate pumps are 2200 gpm, 130 ft total head, 860 rpm.

Other Ingersoll-Rand pumps in the station include those for hydrogen cooling, for boiler filling, for city water and for water-seal service. Two large synchronous motor-driven I-R compressors furnish the air for station service.

Our engineers will appreciate the opportunity of working with you.



COMPRESSORS
TURBO BLOWERS
OIL & GAS ENGINES
PUMPS
CONDENSERS
AIR TOOLS
ROCK DRILLS

Ingersoll-Rand

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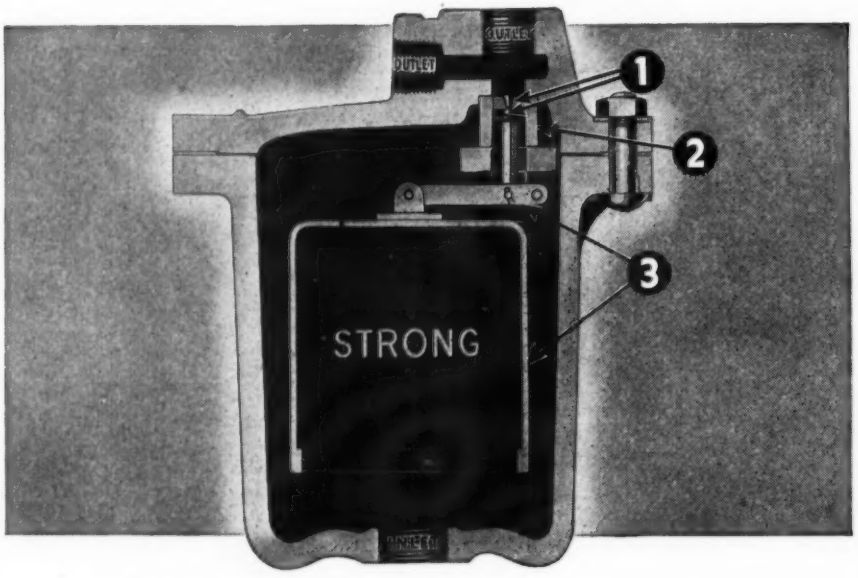
3 Reasons STRONG* Traps are easy to maintain!



Look for these three STRONG low-maintenance features in the STRONG 80 Series Inverted Bucket Trap:

1. **Anum-Metl Valve and Seat—guaranteed leakproof for one year;**
2. **Bolted-in seat design—insures tight seal, easy servicing;**
3. **Stainless steel bucket and trim.**

Compare these features with other traps!

STRONG 80 Series Trap sizes ½" to 2½", pressures to 250 lbs., temperature to 500° F. (forged steel for higher pressures).

Dual outlet simplifies piping, bottom inlet keeps trap cleaner. Years of trouble-free operation assured by super-STRONG construction.

Catalog No. 67 describes inverted, open bucket and other types of STRONG traps. Write today.

*Trade Mark Reg. U. S. Pat. Off.

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1392 West 3rd Street
Cleveland 13, Ohio

REG. TRADE MARK

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OTHER STRONG STEAM SPECIALTIES

Reducing Valve | 70 Series Trap | Strainer

STRONG

Barry Bassett, metallurgist (10) Fred Astbury, final inspection dept (11) George Newsome, security chief (12) James Brannen, tool dept foreman (13) Frank Ormerod, general foreman (14) Harold West, roll grinder foreman (15) George Copeland, time study (16) Bert James, shipping dept foreman (17) John Patterson, maintenance dept foreman (18) Robert Cuthbertson, engineer (19) William Eaton, employment manager (20) Edgar Currah, time study (21) Reginald Bruce, planning dept.

Mica Insulator Co announces establishment of new production facilities at Schenectady, N. Y., for fabrication of mica insulation used primarily in electrical and electronic equipment.

Charles A Burton has been appointed assistant general sales manager of lighting div of **Sylvania Electric Products Inc.** George W Field and Ralph E Niedringhaus will head Central and East Central divisions of Sylvania Electric's sales forces, respectively.

D J Murray Mfg Co announces that their Chicago office is now in Room 648, First National Bank Bldg, 38 S Dearborn St. O J Malina, sales manager of heating and ventilating div, is in charge.

Henry W Kayser has recently assumed new responsibilities at **Falk Corp** with his appointment as supervisor of development engineering.

Minneapolis-Honeywell Regulator Co has formed a subsidiary company in Mexico. The new firm has been named Honeywell-Brown, S. A. Headquarters have been established on Calle De Ramon Guzman, Mexico City. Virgil H Hiermeier has been made manager of the Mexican company.

T R Coffey has been appointed manager of sales of **Globe Steel Tubes Co's** Detroit office at General Motors Bldg.

Burlington Instrument Co has named the following as its representatives: (1) Ernest G Hendrickson, 227 E Sprague Ave, Spokane 8, Wash., for territory covering states of Mont. and Idaho and that part of state of Wash. east of and including counties of Okanogan, Douglas, Grant and Benton (2) Forrest C Valentine, 912 Fort Wayne Bank Bldg, Fort Wayne 2, Ind., covering state of Ind. and Ky, state of Ohio south and west of and including counties of Darke, Shelby, Champaign, Madison, Franklin, Pickaway, Ross, Pike and Scioto (3) White Sales Co, 10 High St, Boston, Mass., for territory covering Conn. and R. I.

Carl C Nelson, works manager in charge of factory production, and James DeKiep, chief engineer, **Electric Machinery Mfg Co,** Minneapolis, Minn., have been named to board of directors.

Sioux Machinery & Supply Co, 315 W 7th St, Sioux City 17, Iowa, has been made authorized distributor for **Carboloy Co.** In addition to Sioux City, Sioux Machin-

Why NICKEL Alloy Steels Are Specified for Giant Generator Shafts

Alloy steel containing two and a half percent Nickel along with small percentages of other alloying elements give the heavy sections of this turbine rotor shaft the strength, toughness and endurance so vital to dependable performance. A yield strength of 80,000 p.s.i. combined with reduction of area consistently exceeding 36% in both radial and transverse directions was achieved in this heavy section.

PHOTO COURTESY OF GENERAL ELECTRIC CO.

HEADED FOR THE LARGEST TURBO-GENERATOR OF ITS TYPE IN THE WORLD

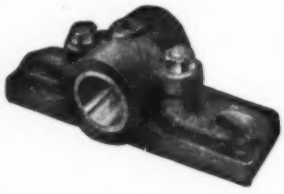
This 75,000 pound Nickel alloy steel rotor shaft will serve in a new record size turbine generator rated at 100,000 KW, 77 feet long, 17 feet wide and designed for inlet conditions of 1250 p.s.i. and 1000° F.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes and other alloys containing Nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

EXTRA SERVICE



"STANDCO"
PILLOW BLOCKS

There's Extra Value in these rugged, well-designed Standco Pillow Blocks with their life-long, trouble-free service.

They are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

Write for Bulletin

"Unbrako" and "Hallowell" Products are sold entirely through Industrial Distributors

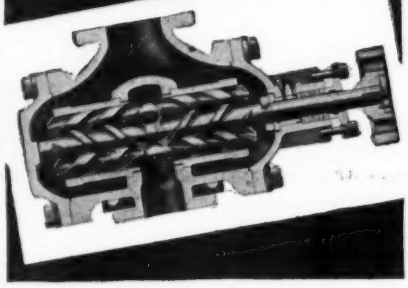
Over 44 Years in Business

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 577

Boston • Chicago • Detroit • Indianapolis
St. Louis • San Francisco

NO GEARS



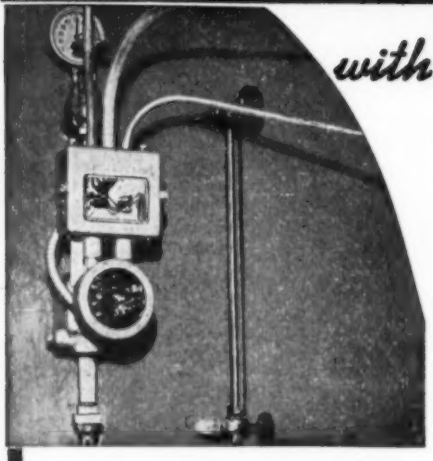
The IMO PUMP requires no gears, because the fluid pumped is propelled from suction to discharge by the action of three intermeshing rotors. That's all there is to it—no gears, valves, vanes or pistons!

For simplicity, reliability and compactness select the IMO—for use in hydraulic service, governor service, lubrication service and other fluid handling services.

For further information send for catalog 1-132-P

IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

No Waterlogging or Air Binding
in HYDRO-PNEUMATIC TANKS EQUIPPED
with DUOTROL



The DUOTROL maintains high water level at a fixed point and correctly balances air pressure after each pumping operation. It provides a maximum volume of water with a minimum of pump operation, saving power and reducing wear. Easy to install, stable adjustments.

The DUOTROL shown is on a tank where water at 50°F. is pumped from a 600 ft. well for summer cooling of a complete shopping center. The pressure range is from 30 to 70 lbs. Ask for Bulletin D-6.

"AUTOMATIC" also makes pressure and float operated pump controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROL Company
1009 UNIVERSITY AVE., ST. PAUL 4, MINN.

AUTOMATIC CONTROLS are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

ery & Supply Co will also supply users throughout northwestern Iowa, S. Dak. and northeastern Neb. C W Monroe, president of Sioux Machinery & Supply Co, will head up the new Carboloy operation.

Chase Brass & Copper Co has promoted Leland S Hanson to sales manager, eastern div. He will eventually make his headquarters at main offices in Waterbury. Herbert H Bartlett succeeds Hanson as manager of the New York branch. G Townsend Underhill has been promoted to manager of Chicago branch.

C J Tagliabue Mfg Co announces removal of its Chicago district sales offices to Room 1120, Merchandise Mart.

Fred W Sparks has joined **Buda Co** as district representative to handle the Ohio territory for the engine div.

Nelson Electric Corp announces appointment of executive personnel and board members of recently organized corporation: (1) George Otis, vice-president and director (2) Daniel W Gage, secretary, director and corporation counsel (3) Jack D Phelan, sales manager and director (4) Eugene Leitner, treasurer (5) Henry Butz, chief engineer.

Hammel-Dahl Co has named Frank J and Arthur T Carr as New England sales representatives operating from Boston, Mass., as Carr Bros Co.

William Mohr has been made regional manager of **Borg-Warner International Corp** in Caribbean zone.

Lord Mfg Co has appointed Dr Stephen J Zand vice-president in charge of engineering.

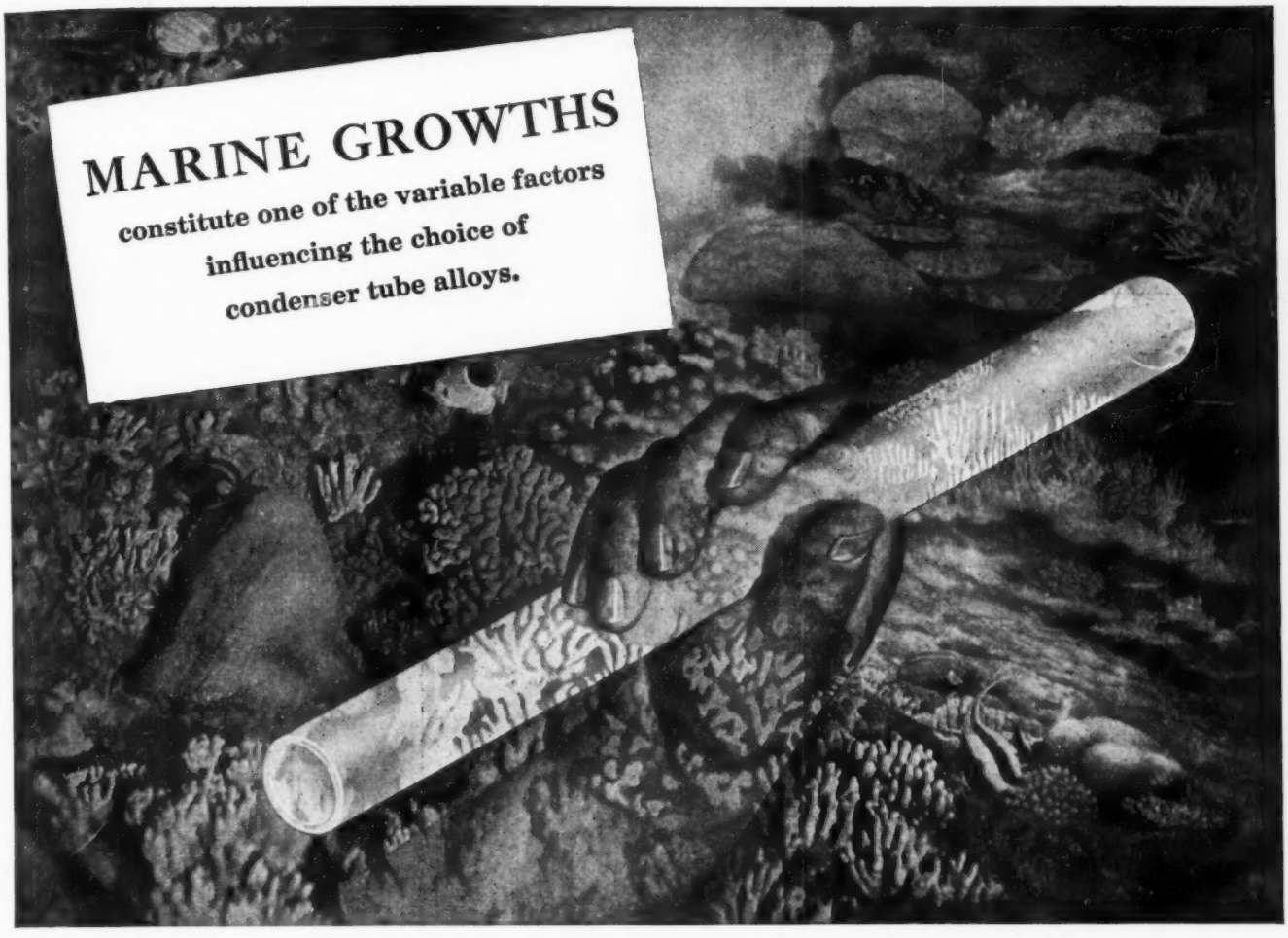
E T Erickson has been placed in charge of Chicago city sales dept of **Dearborn Chemical Co.**

George E Haggas has been named plant manager of southern div of **Central Maine Power Co,** with headquarters at Portland.

Philadelphia Electric Co has elected Horace P Liversidge chairman of board. H B Bryans was elected president, and N E Funk was made executive vice-president and a member of board of directors.

Ernest S Fitz was proposed for election as vice-president in charge of engineering and construction of **Virginia Electric & Power Co.** Erwin H Will is to succeed Fitz as general manager of operations.

Public Service Electric & Gas Co announces following changes in electric generation dept: (1) Walter C Ames Jr became superintendent, Marion generating station, succeeding Percy O Dixon, who retired. (2) Robert A Baker has been named chief engineer of Marion. (3) John A Inwright has been made superintendent of new Sewaren generating station. (4) Earl C McMahon has been appointed chief engineer of Sewaren. (5) Rodney P



Marine growths, not encountered in many heat exchanger installations, can present a problem warranting major consideration in others. One of the most serious consequences resulting from the presence of certain types of marine life is the "concentration cell" established when these organisms attach themselves to and cover a portion of the tube metal, leaving adjacent areas bare. Electro-chemical action between the shielded and unshielded areas ensues, resulting in rapid corrosion adjacent to the line of contact of these areas. Concentration cell action from such causes is often termed "deposit attack".

The presence or absence of marine growths, however, does not, by itself, establish the tube life to be expected in any installation. Other factors which must be considered include:

Velocity and turbulence of coolant . . . Abrasives suspended in coolant . . . Dissolved or entrained air or gases . . . Temperatures inside and outside of tubes . . . Deposits other than marine growths . . . Development of protective film . . . Media surrounding tubes . . . Chemical composition of coolant.

One of the principal objects of Condenser Tube Technical Research has been the development of alloys designed to give longest life and most trouble-free service. Proper alloy selection, however, is often not a complete and sufficient answer when marine growths are a serious problem. Many times it is also necessary to employ frequent normal cleanings and/or chemical treatments such as chlorination in suitable concentrations under the supervision of trained and experienced personnel in order to obtain satisfactory service life from even the best tube alloy available.

Because of the number and variety of conditions surrounding any particular condenser tube installation, each such installation becomes an individual problem, deserving of individual treatment.

Scovill has made, or is making, extensive studies of Condenser Tube Service conditions for every known application, and offers the facilities of its Technical Service Department in the selection of suitable Condenser Tube alloys to meet specific service conditions, in an existing or proposed installation.

THREE SCOVILL SERVICES

Scovill's *Service in Men* offers specialized consultation on individual tube application problems and suggestions regarding alloy selection and tube installation practice. *Service in Metals* includes development and production of a broad range of tube alloys under laboratory control, which verifies that Scovill alloys conform to requirements of specifications. *Service in Manuals* consists of literature providing the latest, most authentic information on condenser and heat exchanger tubes, which has its source in the broad experience of our engineers and the findings of our laboratories.

For a copy of the *Condenser Tube Booklet*, address Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn. *Export Department:* 405 Lexington Ave., New York 17, N. Y.

SCOVILL

SCOVILL

CONDENSER TUBES

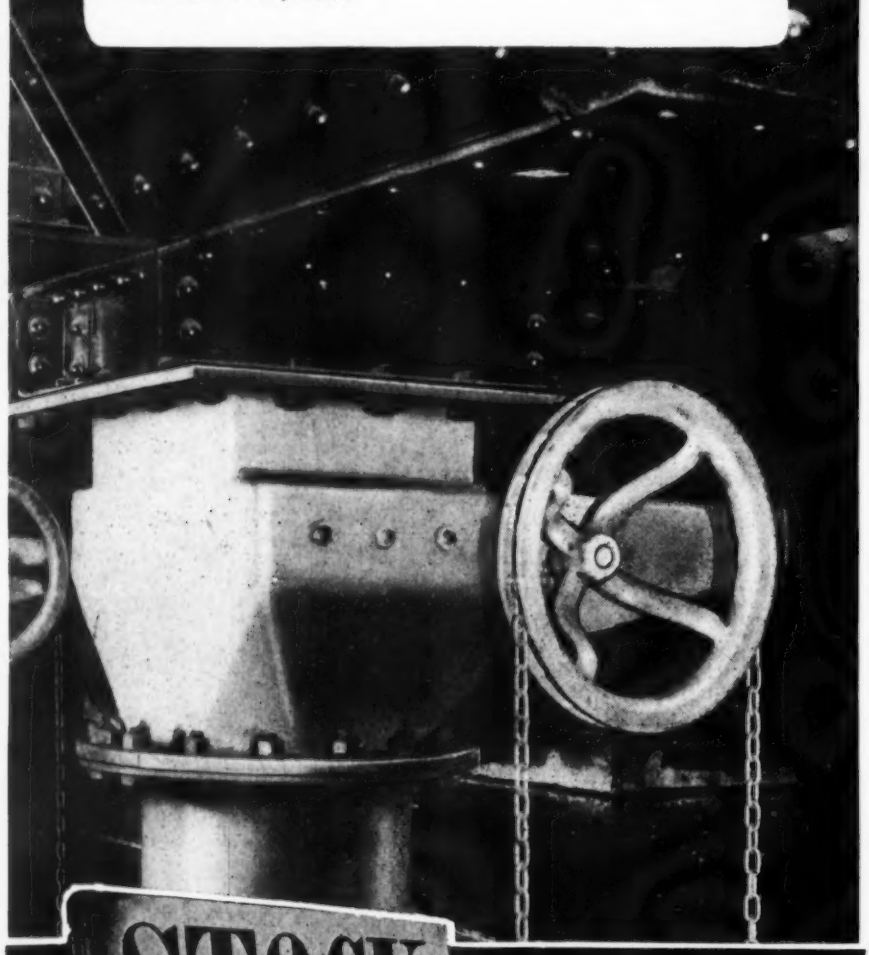
One Product • Three Services

Service in Manuals • Service in Metals • Service in Men

Coal and corrosion can't contact working parts in S. E. Co. Coal Valves . . . can't cause sticking and hard operation. All working parts are shielded — kept free of coal and moisture — and the twin rack and pinion design further insures square opening and closing *every time.*

TWO RACKS + TWO PINIONS = *square closing!*

Write for details. Address
STOCK ENGINEERING COMPANY, 715 HANNA BLDG., CLEVELAND 15, OHIO



STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★ S.E.CO. Coal Valves and Coal Scales

Gibson has been named master mechanic of Sewaren. (6) Harry E Carpenter has become test engineer of Sewaren. (7) William E Karg has been appointed superintendent, Burlington generating station. (8) Elliot A Hussey has been made chief engineer of Burlington. (9) John M Steinsieck has become test engineer of Burlington. (10) Norman S Spatz has been made chief engineer, Perth Amboy generating station. (11) Paul Barth has been appointed chief electrician, Essex generating station. (12) W Clark Padgett has been made boiler room engineer of Essex. (13) Augustus H Tench has been named test engineer of Essex. (14) Gifford Griffin has been appointed test engineer, Kearny generating station.

W J Clapp has been made production superintendent of **Florida Power Corp,** succeeding George Turner, who retired. In recognition of Turner's service, the company has named the former Benson Springs plant the George E Turner plant.

Consumers Public Power District, Columbus, Neb., has appointed W P Venable assistant to General Manager V M Johnson, with direct jurisdiction over several departments. R L Schacht has been made general superintendent in charge of all operating duties. Venable will continue to handle statewide power supply matters and will be in charge of certain other general office departments. Venable will work with Schacht in main system planning.

Norman D Schultze has been made plant engineer of **Sprague Electric Co,** North Adams, Mass.

Arnold W Milliken, vice-president and newly elected member of board of directors of **New York State Electric & Gas Corp,** has been placed in charge of technical operations and will assume additional duties under three advancements. With headquarters in Binghamton, he will assume many of the duties of the late William G Hickling, vice-president and general manager. David A Lewis will come to Binghamton as assistant to Milliken and William G Rhodes will succeed Lewis as manager of eastern div, with headquarters at Brewster.

Alexander Matiuk has joined staff of **Douglas M McBean,** consulting engineer of Rochester, N. Y., as power engineer for design and engineering of steam electric and boiler plants.

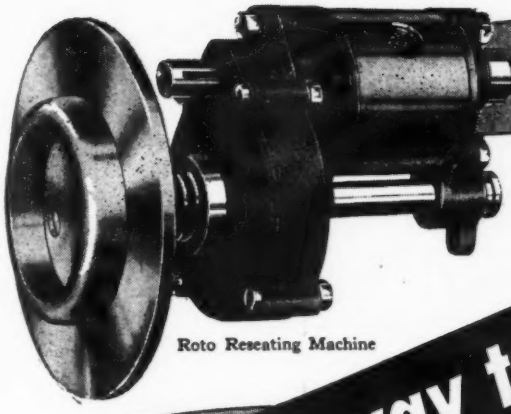
Peter F Loftus Corp, Pittsburgh, Pa., consulting engineers, has announced addition to its staff of Edward T Moore and Charles B Cochran.

Philip B Taylor has become a partner of **Sanderson & Porter.**

The 1947-1948 president of **American Society of Mechanical Engineers** will be E G Bailey, vice-president of Babcock & Wilcox Co. Formal election will take place next fall. Regional vice-presidents named, to serve two years, are: (1) Frank M Gunby, associate of Charles T Main, Inc,

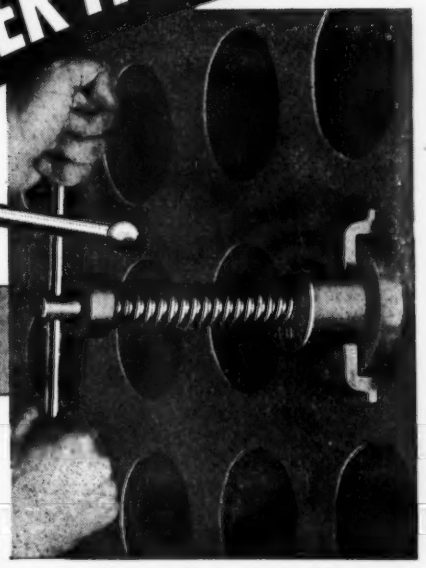
A quick way to clean BOILER HEADERS

with outside caps

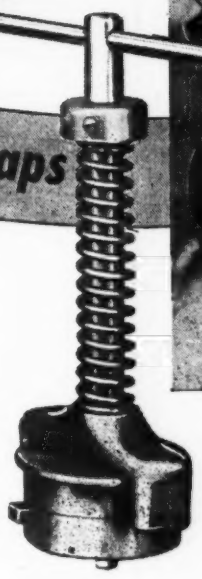


Roto Reseating Machine

with inside caps



Illustrating ease of operation of Roto Hand Hole Seat Scraper



Roto Hand-Hole Seat Scraper for Heine Boiler Headers

Roto offers you a quick, easy means of assuring tight, leak-proof joints between boiler headers and caps. The Roto Reseating Machine removes scale, rust or other adhering matter from headers with outside caps and provides a smooth, true fit.

For boiler headers with inside caps Roto offers a simple hand-hole seat scraper which cleans either round or oval holes. These machines have been used widely for many years, and are sold on a money-back guarantee of satisfaction.

ROTO RESEATING MACHINE

This air-driven machine cleans headers and caps with an abrasive cloth disk fastened to a flat surface plate whose pilot ring accurately centers the disk on the gasket seat. Caps are cleaned by fastening the machine in a vise and holding the cap against the disk. Three pilot rings are furnished; one for the header and two for cleaning both sides of the caps.

The inexpensive abrasive disk is easily replaceable when worn, assuring a true grinding surface at all times. The machine is light (10 lbs) and convenient to handle. It develops 1 hp at 5,000 rpm, and is geared down 5 to 1 to provide ample torque. Send for details and prices.

NOTE—This machine can also be used for cleaning ½" to 1½" condsener tubes by simply removing the surface plate and attaching Roto Extension Shafting with a fluted drill or wire brush.

ROTO HAND-HOLE SEAT SCRAPER

This simple, hand-operated tool consists of a cutting head with retractable cutters, mounted on the end of a revolving spindle having a bearing in a substantial yoke. An adjustable spring automatically maintains tension on the cutters, sufficient to remove all foreign matter but not enough to cut the metal. A few turns to the right and the job is done. A half turn to the left releases the machine.

Roto Scrapers are available for standard round or oval holes. Minor adjustments make them suitable for special sizes or conditions. Write for details and prices.

Make of Boiler	Tube Size	Opening
Babcock & Wilcox	4"	Oval
Babcock & Wilcox No. 40 Header	3¼"	Oval
Babcock & Wilcox No. 41 Header	2"	Oval
Babcock & Wilcox Superheater	2"	Round
Edge Moor	4"	Oval
Heine	3½"	Round
Keeler	4"	Round

ROTO Division of ELLIOTT COMPANY
153 SUSSEX AVENUE - - - NEWARK 1, N. J.

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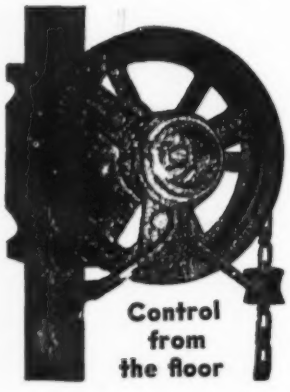

With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

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Removable Self-Starter Strip exposes ends of Labels for you to peel!
DON'T PICK. USE SELF-STARTER STRIP TO PEEL LABELS.
FREE SAMPLES
DON'T PICK. USE SELF-STARTER STRIP TO PEEL LABELS.
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3 IDENTIFY
LIKEWISE ON FLAT SURFACES
*Patents Pending

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QUIK-LABELS code Wires, Leads, Circuits, Relays, Parts, etc., faster and cheaper. • Pre-cut to exact size, QUIK-LABELS come on handy cards. • Ready to use, they stik-quik without moistening, replace slow and costly string tags, roll tapes, decals, stencils, metal tabs, etc. • Silicone plastic coated to resist dirt, grease, abrasion. • *Self Starter Strip automatically exposes ends of Labels for you to grasp instantly—no more finger-picking.

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Established 1914
Manufacturers of Self-Sticking Tape Products
242 W. Wells Street Milwaukee 3, Wisconsin
Factory—Chippewa Falls, Wisconsin

201 Devonshire St, Boston—Region 1 (2) Paul B Eaton, head of mechanical engineering dept, Lafayette College, Easton, Pa.—Region 3 (3) Thomas E Purcell, general superintendent of power stations, Duquesne Light Co, Pittsburgh, Pa.—Region 5 (4) J Calvin Brown, head of firm of J Calvin Brown, 704 South Spring St, Los Angeles—Region 7.

Sam Tour & Co and its affiliate the American Standards Testing Bureau announce appointment of Leslie S Fletcher as technical director.

James Holt of mechanical engineering dept, Massachusetts Institute of Technology, has been elected president of **Engineering Societies of New England, Inc,** succeeding Albert Haertlein of Harvard University.

Percy D Scott has been elected president of **Massachusetts Assn of Power Engineers;** Anthony D Waldron, vice-president; Ernest Beaulieu, secretary; and Chester Babcock, treasurer.

Wendell L Bowen has been made president of **New England Assn of Power Engineers;** Clifford J Lloyd, vice-president; Alexander R Frearn, secretary; and Aldo Rolli, treasurer.

National Association of Relay Manufacturers has been formed. First president is Ralph T Brengle, of Potter & Brumfield Sales Co, Chicago. Also named to executive panel are C P Clare, of C P Clare & Co, Chicago, vice-president; and J J Rowell, of Guardian Electric Mfg Co, Chicago, secretary-treasurer.

Blake D Hull, chief engineer, Southwestern Bell Telephone Co, St. Louis, Mo., was elected president of **American Institute of Electrical Engineers** for the year beginning Aug 1, 1947. Other officers elected were: Vice-Presidents G W Bower, Haddonfield, N. J.; J H Berry, Norfolk, Va.; I M Ellestad, Omaha, Neb.; D I Cone, San Francisco, Calif.; D G Geiger, Toronto, Ont.

Francis B Foley, Philadelphia metallurgical research head, has been nominated president of **American Society for Metals.** All nominations are for 1947-48. Dr H K Work, manager of research and development of Jones & Laughlin Steel Corp, Pittsburgh, was nominated vice-president. F L Spanagel, engineer of industrial dept, Rochester Gas & Electric Corp, Rochester, N. Y., received nomination for 2-year term as treasurer. Dr E G Mahin, professor of metallurgy and head of the dept, Notre Dame University, and C M Carmichael, vice-president, stainless steel and alloys div, Shawinigan Chemicals Ltd, Montreal, Que., were nominated for 2-year terms as national trustees.

C G Dandrow, vice-president, Johns-Manville Sales Corp, and general sales manager of company's industrial products div, has been elected to a 5-year alumni term membership on the **Massachusetts Institute of Technology Corp.** Also elected

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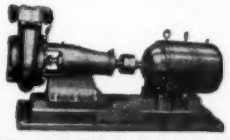
Peerless Centrifugal Pumps
(formerly Dayton-Dowd)
PEERLESS PUMPS
Meet extensive, continuous-duty pumping requirements in all Industries and Municipalities desiring advanced pump design, reduced operating cost and high pump efficiency.



Type DS CENTRIFUGAL PUMPS
For Chemical, Oil, Food Processing, etc.
Capacities: Up to 600 G. P. M. Heads to 230 ft.

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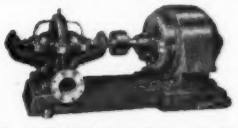
For Butane-Propane, General and Process Work.
Capacities: Up to 150 G. P. M. For high heads.



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Capacities: Up to 60,000 G.P.M. Sizes: 2" to 42".

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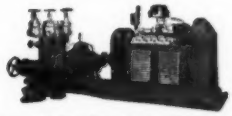
For High Pressures in Refinery, Pipe Line and Boiler Feed Services. Pressures up to 7001bs.



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Underwriters Approved. Capacities 500 to 2000 G. P. M. One of a Variety of Peerless Fire Pumps.

PEERLESS Pump Division manufactures an extensive line of high quality centrifugal pumps for usual or unusual pumping applications. The Peerless staff of highly trained engineers or field representatives will gladly assist you in prescribing the proper pump for your specific application. If you are considering a pump installation demanding long range, trouble-free service, then Plan With Peerless—It will pay!

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Convert Water, Steam and Chemicals into SAFE BOILER FEED WATER

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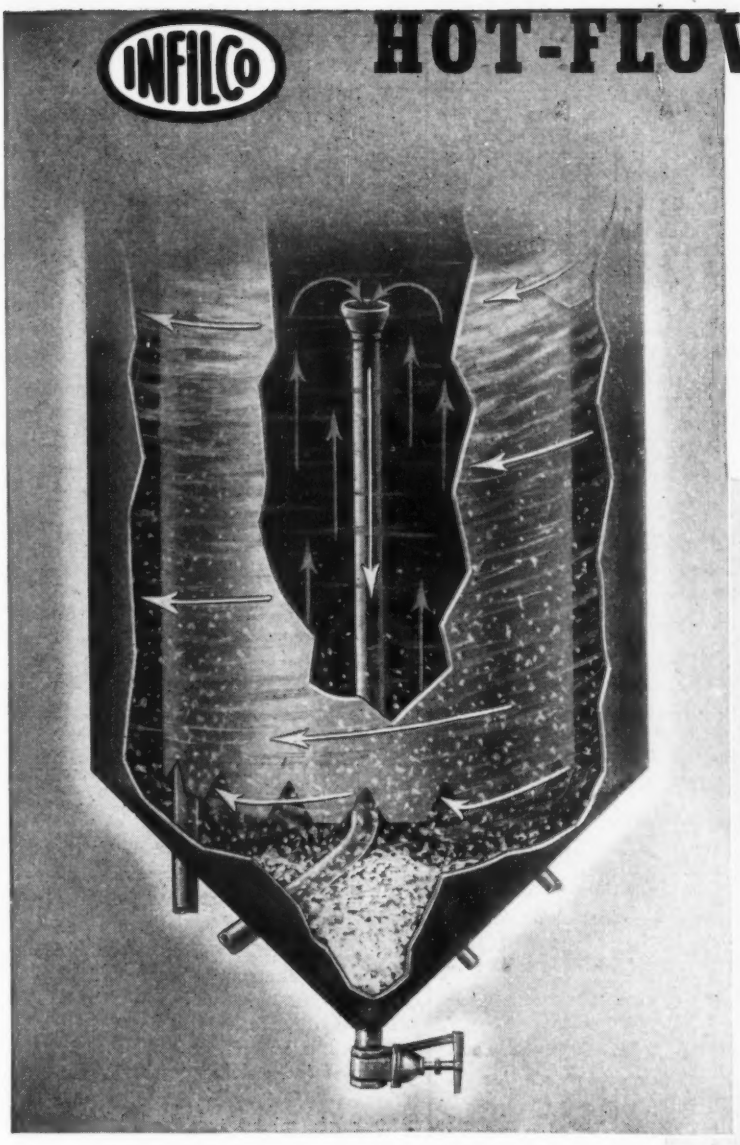

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Infilco Hot-Flow Softener tank is divided into two compartments of equal volume. Chemicals and heated raw water are mixed in the upper annular section above a stilling plate. Chemical reaction is completed as the mixed chemicals and water flow slowly around and downward in the annular section. At the bottom, treated water separates from the precipitate and rises in the central cylindrical uptake to the takeoff, while the sludge settles to the bottom of the tank.

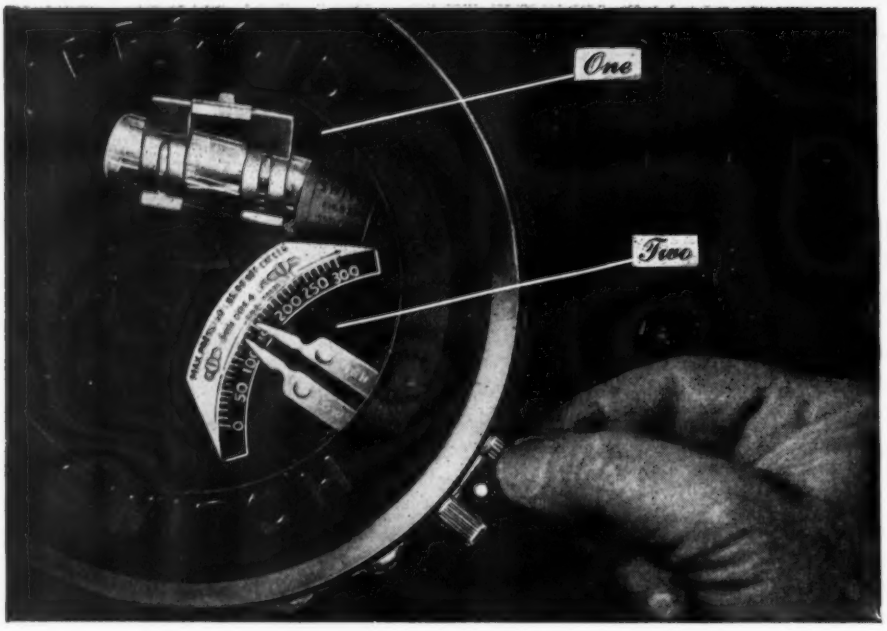
Hot-Flow Softeners combine heating and softening of feedwater, and deaeration when desired, in a single unit. Removal of the bulk of carbonate hardness and silica absorption by lime treatment reduces dissolved solids, silica, and alkalinity. Non-carbonate hardness is removed by use of soda ash in conjunction with lime. The result—low hardness, low silica, SAFE water for boiler feed. Chemicals other than lime and soda ash may be used when required to provide final water of desired characteristics.

Exclusive design features of Hot-Flow Softeners assure maximum treatment results with minimum attendance and overall operating costs.

If water—for boiler feed or other purposes—is one of your production "bottlenecks", it will pay you to find out what INFILCO equipment can do for you in your plant.

When would you like to have one of our engineers call? INFILCO Inc., 325 W. 25th Place, Chicago 16, Ill.

IF YOU WANT TO KNOW — ASK INFILCO



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One *The exclusive use of non-corrosive mercury switches. They have proven time and again that no other type of contact compares so favorably from the standpoint of trouble-free service or long years of continuous operation — without showing evidences of a breakdown.*

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Engineers readily concede the value of these qualifications, due to the relative functional responsibilities involved in automatic controls

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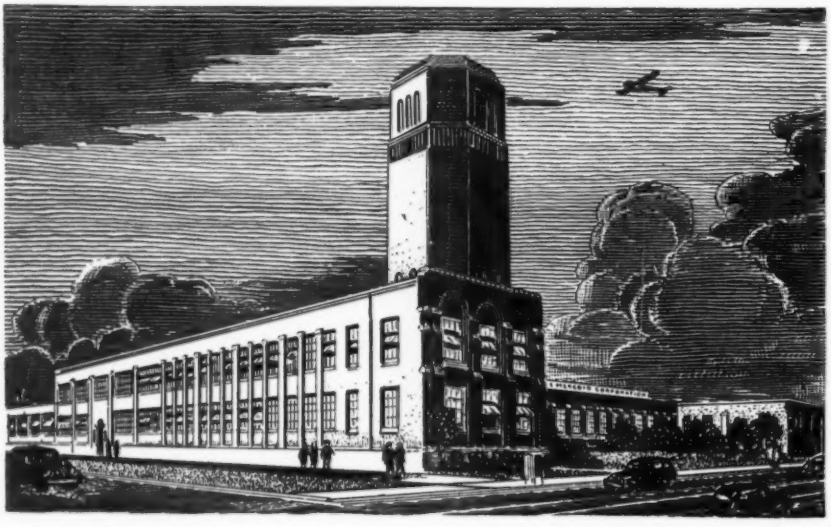

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to 5-year alumni term memberships were James McGown Jr, president of Campbell Soup Co, Camden, N. J., and Harold Bugbee, president of Walter B Snow and Staff, Inc, Boston, Mass.

S C Guillan has been appointed secretary of **Institute of Metals,** London, England, and editor of its publications.

Case Institute of Technology has selected T Keith Glennan, executive of Ansco div, General Aniline & Film Corp, Binghamton, N. Y., and wartime director of U. S. Navy Underwater Sound Laboratory, as president.

American Refractories Institute elected Donald N Watkins a director, succeeding William P Hemphill. Watkins is president and general manager of Laclede-Christy Clay Products Co, St. Louis, Mo.

Carnegie Institute of Technology has named Dennistoun W Ver Planck head of dept of mechanical engineering and professor in that dept.

OBITUARIES

Alfred S Marlow Sr, founder and president of Marlow Pumps, Ridgewood, N. J., died on June 2.

William H Coe, chief engineer of E W Edwards & Son, Syracuse, N. Y., died recently in his Syracuse home after a long illness.

G L Kothny, 66, vice-president and general sales manager of Sperry-Sun Well Surveying Co, a subsidiary of Sun Oil Co, died May 28. He lived at West Valley Rd, Strafford, Pa., and was a prominent inventor of industrial equipment.

Gustavus W Carter, 79, retired chief engineer of Quincy (Mass.) Electric Light & Power Co, died at Quincy on June 25.

Michele Graniero, 76, for many years a stationary engineer at Hotel Utica, died recently in Utica, N. Y., after a brief illness. He retired eight years ago.

Arthur Edgar Smith, 75, founder and president of Bernitz Furnace Appliance Co, Boston, Mass., died at Boston on May 25.

J Marshall McAnern, 38, an engineer for Harvard Brewing Co, Lowell, Mass., died at Billerica Center, Mass., on May 30

Babcock & Wilcox Co plans complete renovation of the grey iron foundry at its plant in Barberton, Ohio. It will cost more than half a million dollars. The renovation will include improvements to the building, as well as machinery replacements and new equipment. The renovation will be designed and carried out by the staff engineering dept, under direction of George J Hartnett Jr.

J H Williams & Co line of drop-forged tools has been broadened by addition of the *Flange-Jack* as a stock item. These tools were formerly manufactured by T G Persson Co, Bloomfield, N. J.

NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library Up To Date With This Convenient Service

BOILERS AND AUXILIARIES

1 **FEEDWATER REGULATOR** — Northern Equipment Co, Erie, Pa. 8-page bulletin No. 471 describes Copes Type P regulator for remote boiler feedwater control.

2 **AUTOMATIC BOILER**—Steamaster Automatic Boiler Co, 5819 S Compton Ave, Los Angeles 11, Calif. 4-page booklet presents the new Steamaster Model A automatic boiler.

3 **DEWATERING COAL** — Robins Conveyors Div, Hewitt-Robins Inc, 270 Passaic Ave., Passaic, N. J. 4-page bulletin on Robins Eliptex Dewaterizer gives facts and case histories demonstrating the ability of this method of removing surface moisture from coal and other materials.

4 **STEAM GENERATORS** — Besler Corp, 4053 Harlan St, Emeryville 8, Calif. 8-page bulletin No. 12A covers construction, operation and specifications of Besler automatic steam generators.

5 **BOILER WATER-LEVEL CONTROL**—Magnetrol, Inc, 2110 S Marshall Blvd, Chicago 23, Ill. 4-page bulletin No. 147 discusses Magnetrol boiler water-level controls. Photos and diagrams are included.

6 **STEAM GENERATOR** — Preferred Utilities Mfg Corp, 1860 Broadway, New York 23, N. Y. 4-page bulletin No. 1100 gives design features and specifications of the 2-pass Preferred unit steam generator.

7 **RAM-FEED STOKERS** — Brownell Co, Dayton 1, Ohio. 8-page bulletin No. S-32 describes LR and LRI ram-feed stokers. Diagrams and photos show construction of these stokers.

8 **PLASTIC FIREBRICK** — Laclede-Christy Clay Products Co, St. Louis, Mo. 40-page booklet gives specifications, installations, applications and engineering data of Laclede plastic firebrick.

9 **STRAIGHT-TUBE BOILER**—Robb Engrg Works Ltd, Amherst, Nova Scotia, Canada. 8-page bulletin No. B105 contains a general description of the Robb-Victory straight-tube heating boiler.

CONTROLS, ELECTRIC

10 **SUPERVISORY EQUIPMENT** — General Electric Co, Schenectady, N. Y. 8-page bulletin No. GEA-1448B describes automatic supervisory equipment for remote control power apparatus. Information on application, operation and use of accessory equipment is illustrated by photos of the units.

11 **CONTROL DEVICES**—Brown Instrument Co, Wayne & Robert Ave, Philadelphia 44, Pa. 56-page catalog No. 8302 presents informative data on electric and pneumatic automatic control systems.

12 **SUPERVISORY EQUIPMENT** — Control Corp, 718 Central Ave, Minneapolis 14, Minn. Publication No. TA3 explains operation and advantages of Peak-Trol, a new method of controlling off-peak loads.

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CONTROLS, MECHANICAL

13 **REGULATOR LINE**—Leslie Co, 50 Delafield Ave, Lyndhurst, N. J. 4-page bulletin No. 468, entitled "Interchangeability," discusses four important phases of interchangeability as applied to Leslie line of regulators. This booklet lists, in table form, key internal working parts of regulators that are renewable and interchangeable in various sizes of Leslie regulators serving different functions.

14 **ELECTRONIC SERVOMECHANISM**—W C Robinette Co, 802 Fair Oaks Ave, S Pasadena, Calif. Bulletin No. H-26 presents Servo Model 61A—a packaged continuous-balance control system that can be applied to automatic control or regulation of a large variety of practical problems to eliminate need of human supervision.

15 **POSITION INDICATOR**—General Electric Co, Schenectady, N. Y. 20-page booklet No. GET-1304 contains information on selection and application of dc selsyn 3-wire system indicators and transmitters.

16 **PRESSURE AND LEVEL CONTROL**—Kieley & Mueller Inc, 2033 43rd St, North Bergen, N. J. 114-page catalog No. 47 describes liquid-level controllers, Kontrol motor diaphragm valves, strainers, pressure reducing and regulating valves, pump governors, etc.

ELECTRICAL EQUIPMENT

17 **POWER GENERATION** — Allis-Chalmers Mfg Co, Box 512, Milwaukee 1, Wis. 32-page Annual Review booklet reveals engineering progress that was achieved by Allis-Chalmers during the past year.

18 **ELECTRICAL INSULATION** — Dow Corning Corp, Midland, Mich. Preliminary data sheets No. B-30-1 list all of the materials necessary to insure maximum service life in motors rewound with Silicone insulation.

19 **PERMANENT MAGNETS**—Metallurgy div, chemical dept, General Electric Co, Pittsfield, Mass. 36-page booklet No. CDM-1 gives all general information on permanent magnets, as well as technical data on characteristics, designs, properties and applications of GE material.

20 **SYNCHRONOUS MOTORS**—Electric Machinery Mfg Co, Minneapolis 14, Minn. 16-page booklet, entitled "The E-M Synchronizer," Vol 8, No. 2, tells why external motor protection is important and also explains how to figure voltage drop. Protective arrangements for motors are defined.

21 **STATION CUBICLES** — General Electric Co, Schenectady, N. Y. 24-page bulletin No. GEA-3658A describes GE station cubicles with air-blast breakers and pneumatic operating mechanisms, factory assembled in steel housings. These cubicles are for power-station service up to 34,500 v and 2,500,000 kva.

22 **VARIABLE RECTIFIERS**—Rectifier engrg div, Richardson-Allen Corp, 15 W 20th St, New York 11, N. Y. Bulletin No. 5M-11-46 gives applications, advantages and applications of Richardson-Allen variable rectifiers for dc power requirements.

23 **ELECTRICAL DIAGRAMS**—General Electric Co, Schenectady, N. Y. 24-page bulletin No. GET-1293 explains purpose and use of electrical diagrams supplied with GE switchgear equipment.

24 **SMALL MULTIBREAKER** — Cutler-Hammer, Inc, 294 N 12th St, Milwaukee 1, Wis. 4-page folder No. MS-20 presents features of the new Cutler-Hammer MO-4 multibreaker.

25 **CONTROL AND TRANSFER SWITCH**—Apparatus dept, General Electric Co, Schenectady, N. Y. 12-page bulletin GEA-4746 covers SB-1 control and transfer switch for opening, closing and transferring of low-capacity circuits up to 20 amp at 600 v ac or dc.

MAINTENANCE AND SAFETY EQUIPMENT

26 **TUBE EXPANDER**—Gustav Wiedeke Co, 1833 Richard St, Dayton 1, Ohio. Ideal bulletin No. 65-B announces the improved 1500 Ideal tube expander, designed with a new short frame especially desirable for use in small headers or other close quarters where tube holes are not in direct line with hand holes.

27 **KEYWAY BROACHES AND SETS** —du Mont Corp, Greenfield, Mass. 12-page catalog contains complete information on Minute Man keyway broaches and kits and du Mont arbor presses.

28 **MATERIAL DRYER** — Link-Belt Co, 300 W Pershing Rd, Chicago 9, Ill. 12-page booklet No. 2209 discusses Link-Belt Multi-Louvre dryer, a new design that is recommended for materials requiring short treatment time and/or multiple drying temperatures.

29 **PIPE BENDER**—Electric Cord Co, 30 Church St, New York 7, N. Y. Sheet gives three simple steps for operation of Aujax pipe bender. This new portable hydraulic pipe bender comes in 24 and 30 in. sizes.

MAINTENANCE MATERIALS

30 **PROTECTIVE COATINGS**—Prufcoat Laboratories, Inc, 50 E 42nd St, New York 17, N. Y. Booklet, along with price list, color card and application specifications, covers protective coatings for masonry, metal and wood.

31 **FLOOR CLEANER**—Safety & Maintenance Co, 1 Wall St, New York 5, N. Y. 6-page folder FB-19 presents Sol-Speedi-Dri, a product that absorbs oil and frees floors from dangerous grease accumulations. Free sample is sent with folder.

32 **PAINT-BRUSH CONDITIONER**—Wisconsin Laboratories, Inc., 625 N 23rd St, Milwaukee 3, Wis. Sheet, entitled "New Methods for Taking Care of Paint Brushes," announces Protexem paint brush conditioner. 4-page folder tells how Protexem works.

METERS AND INSTRUMENTS, ELECTRIC

33 **INSULATION TESTER**—James G. Biddle Co, 1211 Arch St, Philadelphia 7, Pa. Bulletin No. 21-46-24 describes a megger insulation tester that can be "plugged in" instead of hand cranked.

34 **AC LOAD VISUALIZER**—General Electric Co, Schenectady 5, N. Y. 4-page bulletin No. GEA-4784 discusses the new Type AF-1 ac load visualizer, a lightweight low-cost analyzer for single-phase and balanced polyphase systems.

(*Continued on page* 206)

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USE BITUPLASTIC FOR VAPOR SEALING SURFACES EXPOSED TO CORROSION . . .

EACH COAT OF KOPPERS

BITUPLASTIC

EQUALS 5 COATS OF PAINT

Bituplastic is *not paint*

IT IS . . .

- ✓ a highly refined, easily workable coal tar base coating
- ✓ applied cold with brush or standard spray
- ✓ a complete vapor seal
- ✓ fire retardant
- ✓ impervious to temperatures of −50° F to +500° F
- ✓ applicable to damp surfaces
- ✓ virtually odorless and tasteless
- ✓ quick drying (usually a matter of minutes)

THE BASE IS TOUGH . . .

a time proved seal against corrosion . . . refined coal tar—as a stable dispersion in water—forms a thick plastic coating for the protection of metal, concrete or masonry surfaces.

AND THE COAT IS THICK . . .

Bituplastic covers heavily; 1/64" to a coat, or about 5 times the thickness of ordinary paint. Successive applications can provide a seamless, non-porous sheath up to 1/16" in thickness, completely resistant to most corrosive conditions.

USE A BRUSH . . . OR STANDARD SPRAY

Suggestions for use, rate of coverage and other data are in a new Bulletin on Bituplastic. Ask your distributor or address . . .

KOPPERS COMPANY, INC.

WAILES DOVE-HERMISTON DEPARTMENT

WESTFIELD, NEW JERSEY

35 **INSULATION TESTER**—James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 12-page bulletin No. 21-60-24 covers Bridge-Meg type of megger insulation and resistance tester.

METERS AND INSTRUMENTS MECHANICAL

36 **SPECIFIC-GRAVITY TESTERS**—Dept 6G-B, Fischer & Porter Co, Hatboro, Pa. Catalog section 91-B includes dimensional and operational details of an improved continuous-liquid specific-gravity indicator.

37 **PRESSURE GAGES**—Clapp Instrument Co, Webster, Mass. 16-page catalog describes the Acragage. This catalog includes a list of pressure gages for different services.

38 **VARIABLE-AREA FLOW-RATE METER**—Dept 6G-C, Fischer & Porter Co, Hatboro, Pa. 24-page bulletin discusses Flowrator instruments for measuring flow rate of liquids and gases.

PIPING, FITTINGS, VALVES AND SPECIALTIES

39 **NICKEL-STEEL TUBING** — Advertising div, Babcock & Wilcox Tube Co, 85 Liberty St, New York, N. Y. 10-page bulletin No. TR-508 covers mechanical and working characteristics, heat-treating behavior and weldability of the newly developed 9% nickel-steel tubing. It also suggests fields of application.

40 **PLUG VALVES**—Duriron Co, Dayton 1, Ohio. 2-page bulletin gives complete details on Durco corrosion-resistant top-lubricated plug valves made of Duriron or Durichlor.

41 **CONDUIT SYSTEMS**—Ric-wiL Co, Cleveland, Ohio. Form 4704 discusses specifications and descriptions of various basic types of tile and cast-iron conduit for underground steam, return, hot-water and oil lines.

42 **VALVE CHART**—Ohio Injector Co, Wadsworth, Ohio. 20-page valve cross-reference chart contains a complete listing of OIC valve numbers in order, with their description.

43 **PARABOLIC FLUME** — Simplex Valve & Meter Co, 68th & Upland Ct, Philadelphia 42, Pa. 8-page bulletin No. 210 describes Simplex Type S parabolic flume for open flow of water, sewage and industrial liquids.

44 **CORROSION-RESISTANT VALVES**—Alloy Steel Products Co, Linden, N. J. 54-page catalog No. 47 gives complete descriptions of all standard Aloyco corrosion-resistant valves and fittings.

45 **FORGED-STEEL FITTINGS**—Fittings div, Ladish Drop Forge Co, Cudahy, Wis. 44-page booklet, Volume 2, Second Edition, covers all types, sizes and pressure ratings of fittings in Ladish line.

46 **CHECK VALVE**—Williams Gauge Co, 1620 Pennsylvania Ave, Pittsburgh 12, Pa. 4-page bulletin No. WH50 describes features of Williams-Hager flanged silent check valve.

47 **EXPANSION JOINT** — American District Steam Co, North Tonawanda, N. Y. 8-page bulletin No. 35-30D discusses ADSCO internally guided expansion joint for steam, water, oil and other pipelines. Bulletin gives details of construction, dimensions and list prices in sizes from 1¼ to 20 in. in single and double joints for working pressures to 300 psi.

48 **IRON AND STEEL VALVES** — Lunkenheimer Co, Cincinnati, Ohio. 34-page booklet, entitled "The Inside Story of Lunkenheimer Valves," provides a pictorial inspection tour of the Lunkenheimer plants. Booklet also gives a few significant facts about use of Lunkenheimer valves.

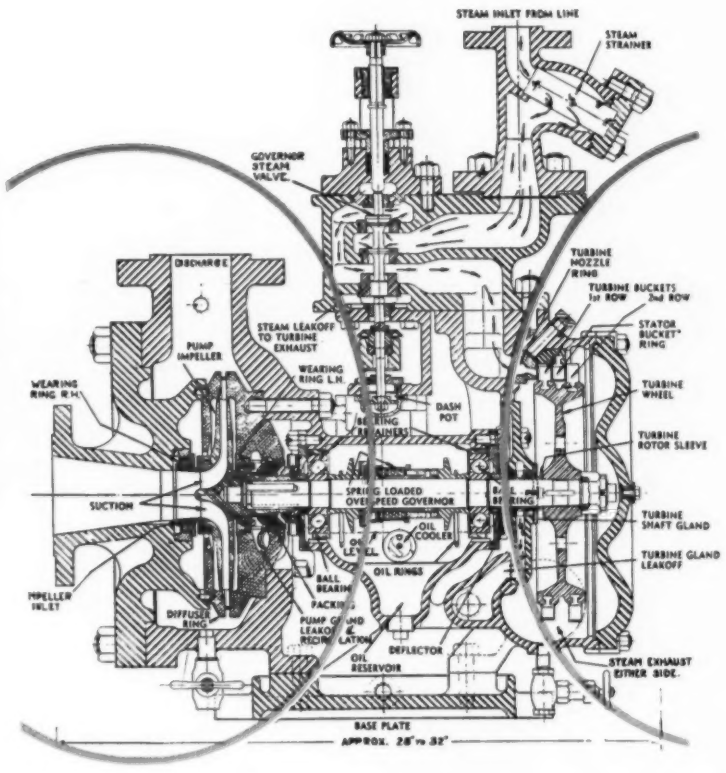
49 **STRAINERS**—A W Cash Valve Mfg Corp, 666 E Wabash Ave, Decatur 60, Ill. 4-page bulletin No. 224 presents the new Type SY strainer. Type S strainer is also described in this folder, as well as a list of all current Cash-Acme bulletins.

COFFIN TURBO PUMPS

HIGH SPEED • SINGLE STAGE

6 High efficiency pump plus high speed two bucket row turbine result in minimum steam consumption.

COFFIN single stage pumps at 7200 RPM are approximately the equivalent of 3 to 6 stage pumps at 3600 RPM. Net positive suction head requirements are normal.

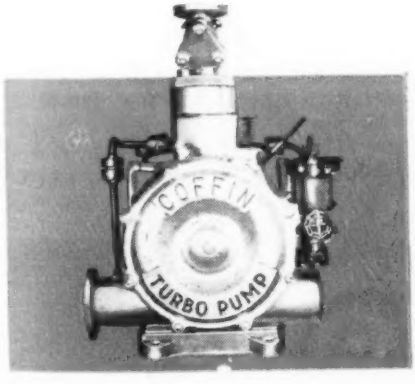


COFFIN 12" turbine bucket wheels at 7200 RPM are approximately equivalent to 24" turbine bucket wheels at 3600 RPM.

Standardized Boiler Feed Units for:

Steam Pressures to 650 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F



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1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine result in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

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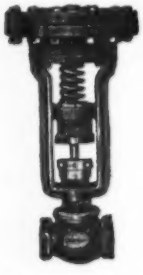
ATLAS

It was the great William Shakespeare who said,

"What's in a name?"

It is quite possible that in Shakespeare's day a name didn't mean much. Now, though, when a reducing valve is marked ATLAS or when *any* regulating valve for *any* service is marked ATLAS, it means that it is the best and most dependable obtainable.



Consider, for example, The

ATLAS

Type "D" REDUCING VALVE

which we illustrate above. Among engineers this valve is becoming more and more popular for a number of good reasons:

First: Its unusual simplicity always insures notably accurate and close regulation of pressures.

Second: It is so easy to inspect. It is equipped with single seat renewable discs of composition or metal; stainless steel valve stem; and removable diaphragm top.

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Fourth: It is durable to a high degree. Bodies are of bronze. Screwed ends.

Fifth: Its construction gives it true balance with double port seats.

So, don't hesitate to put your regulating problems in the hands of ATLAS engineers. We have specialized solely in regulating valves for nearly a half century. We shall be glad to send you specific data on this or other ATLAS products. Make use of the coupon below.

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☐ Without obligation, please send me the "ATLAS Reducing Valve Data and Price Book." Also, please send complete information on the following ATLAS products:

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☐ Exhaust Control Systems
☐ Pressure Regulators
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☐ Float Valves
☐ Oil Control Cocks
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves

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Firm .....

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VALVES

50 **STEAM SPECIALTIES** — Wright-Austin Co, 315 W Woodbridge St, Detroit 26, Mich. 4-page bulletin No. 715 describes three steam traps and three steam separators, together with illustrations and brief descriptions of 22 other products.

51 **INSULATED PIPE UNITS**—RicwiL Co, Cleveland, Ohio. 16-page booklet, Form No. 4626-5M, lists specifications for underground pipe distribution systems employing prefabricated insulated pipe conduit.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **TUBULAR PRODUCTS** — Wallace Tube Co, 1300 Diversey Parkway, Chicago 14, Ill. 66-page engineering data book contains information on properties of boiler tubing, condenser tubing, heat-exchanger tubing, pressure tubing, seamless and stainless steel piping, etc. Book sent only to purchasing agents and engineers.

PRIME MOVERS AND ACCESSORIES

52 **MECHANICAL-DRIVE TURBINE** —Elliott Co, Jeannette, Pa. 12-page bulletin No. H-16 describes the new Elliott YR mechanical-drive turbine. It gives a brief history of development of mechanical-drive turbines.

53 **STEAM ENGINES**—Troy Engine & Machine Co, Troy, Pa. 8-page bulletin No. 306 discusses vertical types of Troy-Engberg steam engines. Construction details are given.

54 **JET-PROPULSION ENGINES** — Westinghouse Electric Corp, P O Box 868, Pittsburgh 30, Pa. Booklet No. B-3834 presents the Yankee line of jet-propulsion engines.

55 **STEAM ENGINES**—Troy Engine & Machine Co, Troy, Pa. 8-page bulletin describes the horizontal types of Troy-Engberg steam engines. Photos and sectional drawings are included.

PUMPS

56 **MATERIALS-HANDLING PUMP** —Allen-Sherman-Hoff Co, 225 S 15th St, Philadelphia, Pa. 16-page catalog No. 547 features improvements made in the Hydroseal materials-handling pump since the war.

57 **SELF-PRIMING PUMPS** — Baltimore Pump & Equipment Corp, 1913 St. Paul St, Baltimore 18, Md. 4-page booklet gives features and operation of Huber Squeegee pump and Cyl-O-Phragm pump.

58 **CENTRIFUGAL PUMPS**—Warren Steam Pump Co, Warren, Mass. 6-page revised bulletin No. 227 discusses specifications of Types DM and DL single-stage double-suction centrifugal pumps. 4-page revised bulletin No. 236 covers specifications of Type DBH single-stage double-suction centrifugal pumps. Ratings and dimensions are included in both bulletins.

59 **BULK-STATION PUMP** — Pump div, Byron Jackson Co, Box 2017, Terminal Annex, Los Angeles 54, Calif. 4-page bulletin No. 46-7000 describes the TLB pump, a centrifugal pump that handles gasoline, butane, diesel fuels, lubricating oils and other hydrocarbons for bulk-station service.

60 **MIXED-FLOW PUMP** — Peerless pump div, Food Machinery Corp, 301 W Ave 26, Los Angeles 31, Calif. 24-page bulletin No. B-148 discusses the Peerless mixed-flow pump. It furnishes information to prospective pump buyers whose applications require moving or removing of water in capacities up to 220,000 gpm.

61 **CENTRIFUGAL PUMPS** — National Transit Pump & Machine Co, Oil City, Pa. 8-page bulletin No. 6000 gives applications, advantages, specifications and operating ranges of line of process centrifugal pumps.

STOP

HEAT LOSS by a

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at RANAREX*

LISTEN:

THERE'S no time lag with Ranarex, while precious heat goes up the stack. This *mechanical* CO_2 indicator and recorder gives you constant, instant readings—accurate to within 3/10 of 1%!

Users report Ranarex saves them as much as 20% on up-the-stack heat loss. You'll find big savings, too, with this rugged, dependable fuel-economizer.

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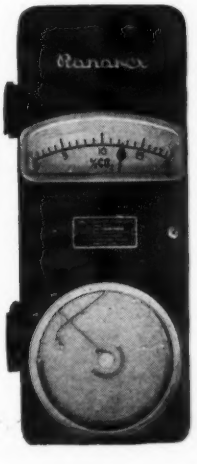
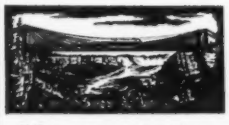
RANAREX

CUTS UP-THE-STACK HEAT LOSS



CONFIDENCE...how much is it worth?



EVEN IN THIS ATOMIC ERA, what engineer wouldn't be awed at the possibility of building a bridge of his own design across the hazardous Niagara gorge? Yet John A. Roebling was commissioned to do just that *98 years ago* . . . ten years before this country's first oil well was drilled!

What an outstanding example of confidence. The confidence of a man in his own work. The confidence of people in one man and his abilities . . .

Today this same confidence, that has been nurtured through the years, is still alive in the company founded by this man and his sons. On this same foundation was built a business that has always believed that confidence must be created and grows through completely honest business transactions with each and every one of its customers.

Little wonder, then, that your confidence in John A. Roebling's Sons Company is guarded so carefully.

Why Production Men Specify "Blue Center" Steel Wire Rope

BASICALLY, there is but *one* reason: a firm confidence in the Roebling name and reputation, in the Roebling organization and representatives, in the quality of the wire rope itself.

Of course, there are other reasons, too. You have the assurance that the complete range of constructions and sizes in "Blue Center" Steel Wire Rope includes the *right* rope for your installation. And whether it's a preformed or non-preformed type, you can trust it to give you most service for the money.

Let a Roebling Field Engineer advise you on unusual problems of rope selection, operation and maintenance. His knowledge is based on his own experience *plus* field studies, research and thousands of service records studied by Roebling's Engineering Department. Call him at our nearest branch office.

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Complete
VARIABLE SPEED DRIVE
LOVEJOY IDEAL CHICAGO
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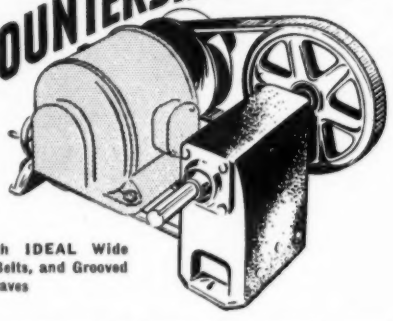

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- For thousands of uses where variable speed was formerly impossible.
- For speed-up or slow speed drives. 3:1 speed ratio.
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- Accurate, instant finger-tip control of speeds.
- Five pulley sizes up to 8 hp.
- All metal. Non breakable steel sheave. Pressure lubricated.

SEND for IDEAL Catalog. Also shows Variable Speed Pulleys, "Select-o-Speed" Transmission, Wide, V-Belts, Adjustable Motor Bases, etc.

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Every unit guaranteed for 10 years!

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WATER TREATMENT

62 **WATER-CONDITIONING CHEMICALS**—Wright Chemical Corp, 627 W Lake St, Chicago 6, Ill. 4-page booklet describes Wright organic chemicals for conditioning aqueous systems.

63 **BOILER WATER-LEVEL CONTROL**—Northern Equipment Co, 1945 Grove Dr, Erie, Pa. 16-page bulletin No. 469, entitled "Boiler Water Level Control at 12th Street, Reeves Avenue and Chesterfield Stations of Virginia Electric & Power Co," gives important data on the subject.

64 **ORGANIC WATER TREATMENT**—Water Treatment Co of America, 1159 Hodgkiss St, Pittsburgh, Pa. 8-page bulletin No. 15 tells how Baerite No. 15 treats boiler feedwater.

WELDING

65 **ELECTRODE HOLDER**—Tweco Products Co, P O Box 666, Wichita 1, Kan. Form No. KD-316 announces the new Model A-316 Twecotong electrode holder.

66 **ELECTRODES AND ALLOYS**—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. 24-page bulletin No. 68B covers Ampcoloy resistance welding electrodes and alloys. A price list is included with this bulletin.

67 **ARC-WELDING ACCESSORIES**—Hobart Brothers Co, Box DM-709, Troy, Ohio. Folder No. J-1711 describes Hobart accessories for arc welding. Photographs are included.

68 **BRONZE WELDING ELECTRODES**—Ampco Metal, Inc, 1745 S 38th St, Milwaukee 4, Wis. Welding procedure sheets, entitled "Ampco Procedure for Welding Tin Bronzes," and "Ampco Welding Procedure for Brass," cover use of Ampco bronze electrodes in joining and overlaying these alloys.

OTHER EQUIPMENT

69 **COMPRESSOR APPLICATIONS**—Clark Bros Co, Olean, N. Y. 12-page booklet, entitled "Cotton Valley Five Years Later," presents a history of benefits of utilization and practices involved in pressure maintenance at this plant.

70 **PORTABLE COMPRESSORS**—Davey Compressor Co, Kent, Ohio. 4-page bulletin describes new Davey Air Chief portable compressors. This bulletin includes photos and detailed mechanical specifications of 60, 105, 160, 210 and 315 cfm capacity machines.

71 **HEAT EXCHANGERS**—Duriron Co, Dayton 1, Ohio. 4-page bulletin No. 1603 presents Durco heat exchangers for heating and cooling corrosive liquids.

72 **CAR DUMPERS**—Link-Belt Co, 300 W Pershing Rd, Chicago 9, Ill. 20-page booklet No. 2048-A discusses Link-Belt rotary dumpers. Photos and drawings are included.

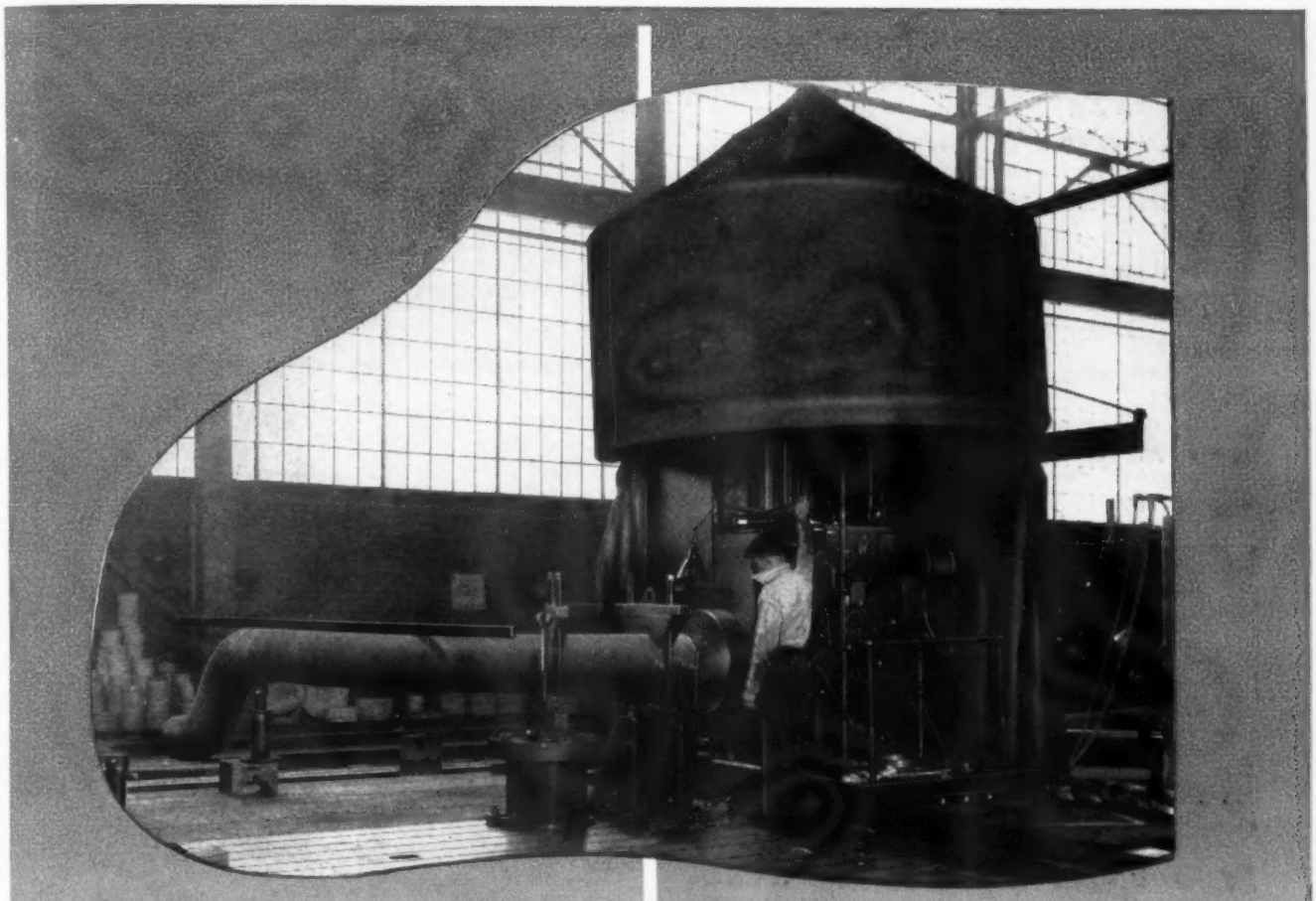
73 **NICKEL ALLOYS**—International Nickel Co, 67 Wall St, New York 5, N. Y. Compressed handbook and guide, entitled "Nickel and High Nickel Alloys," gives informative data on nickel, monel, Inconel and associated alloys.

74 **ADJUSTABLE V-BELT**—Manheim Mfg & Belting Co, Manheim, Pa. 24-page Veelos V-belt catalog describes features of adjustable V-belt, construction details, illustrates how to couple and uncouple, measure and install.

75 **CHAIN DRIVE**—Link-Belt Co, 220 S Belmont Ave, Indianapolis 6, Ind. 16-page booklet No. 2010 contains dimensions of sprocket wheels, hp ratings and information on how to select a chain drive, including calculation of chain-drive centers and length of chain required.

76 **LAMINATED PLASTICS**—Plastics div, chemical dept, General Electric Co, 1 Plastics Ave, Pittsfield, Mass. 64-page booklet No CDP-548 gives complete information on manufacture, application engineering and properties of all Textolite laminated plastics. It lists 44 different grades of the sheet material, along with their electrical, physical and mechanical properties.

MODERN PRESSURE PIPING REQUIRES SPECIALIZED SHOP FACILITIES AND PERSONNEL



SPECIAL MACHINE TOOLS

are Used by the QUALIFIED PIPE FABRICATOR to Maintain Quality

Correct fabrication of modern pressure piping calls for considerable special machining. For example, simple flame cut bevels are not suitable for welding in most pressure work. Welding procedures demand special shape machine-cut bevels . . . smooth and without irregularities.

Accordingly, qualified fabricators maintain specialized machine tools for preparing pipe ends for welding . . . machining recesses for backing rings . . . accurate front and back facing of lap joint ends . . . refacing flanges . . . cutting complicated contours required for branch line welds . . . machining test holes and removing sample coupons for testing . . . all to engineered tolerances.

Only the qualified fabricating shop, working regularly on modern piping can afford the investment in these machines—and they are essential to maintain the highest quality.

Pre-fabricated piping is better piping because the qualified fabricators have specialized equipment and the trained organizations to make it better. And the best piping is the most economical piping.

THE PIPE FABRICATION INSTITUTE

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Devoted to the Technical and Economic Problems in Piping

1109 CLARK BUILDING PITTSBURGH, PA.

Write for Technical Bulletin describing pressure piping fabrication

3029

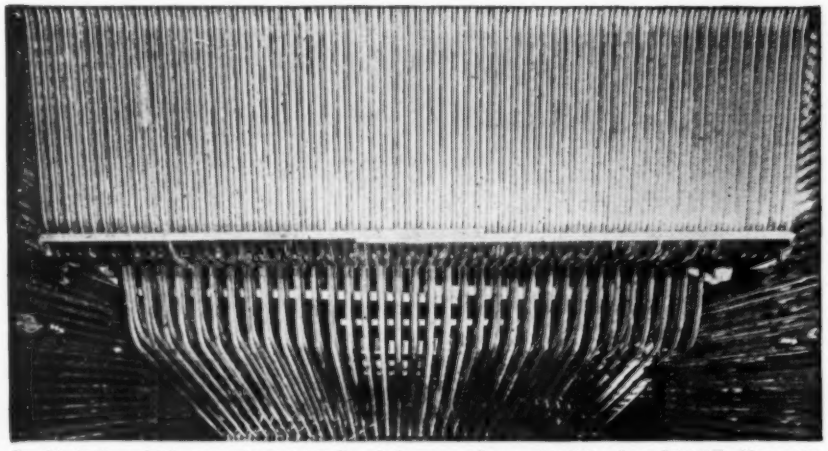
We call this

the "ACCORDION TEST"

It looks like a section of rubber hose with a bad case of cramps.
It's a NATIONAL Seamless Boiler Tube after being mashed together from the ends. Only a tube that is pierced from solid steel—and not just ordinary steel either —could stand this kind of treatment without wall failure.

WE show this unusual test because we think it illustrates at a glance why we have always emphasized the "Walls Without Welds" construction of U·S·S NATIONAL Seamless Boiler Tubes . . . why users say they are unsurpassed for safety.

There are other reasons* too, why NATIONAL Seamless Tubes, for more than half a century, have earned the complete confidence of power plant operators. As temperatures and pressures have gone up, these superior tubes have never been found wanting. Under increasingly severe conditions they have continually demonstrated their ability to ensure lasting economy and superb performance.



In this boiler which generates 615,000 lb. of steam per hour, at 1,475 psi. and 925°F., NATIONAL Seamless "Walls Without Welds" insure absolutely uniform wall strength.

**Higher Creep Strength*

All steels used in U·S·S NATIONAL Seamless Boiler Tubes are of the completely "killed" type—the steel is thoroughly deoxidized before being cast into ingots. Tests have shown conclusively that "killed" steels have better creep strength at elevated temperatures than "rimmed" steels of similar chemical analysis commonly used for other types of tubes.

**Superior Heat Transfer Characteristics*

U·S·S NATIONAL Seamless Boiler Tubes made of completely "killed" type of steels have uniform density, freedom from laminations, and soundness of structure throughout the metal walls. This provides superior heat transfer characteristics with minimum danger of "hot spots" —a worthwhile consideration in every kind of boiler tube service.

**Better Working Properties*

U·S·S NATIONAL Tubes can be readily bent, expanded, flared, beaded, and rolled tightly into headers or sheets without splitting or fracture. These qualities greatly reduce construction and maintenance costs. Complete annealing insures the right balance between strength and ductility for good performance and utmost ease of installation.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Tubing Specialties Division

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

NATIONAL TUBE COMPANY USS STEEL UNITED STATES STEEL

UNITED STATES STEEL

Coming Events don't always CAST THEIR SHADOWS...

Particularly in the Power Plant Field.

Plant Outage, for instance, can and usually does strike at any time *without warning.* But how many or *how few* shut-downs you have may depend entirely on the effectiveness of your water conditioning service.

Correct water conditioning is a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Our staff of engineers will welcome the opportunity of discussing your boiler water problems . . . W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

Take a WALWORTH No. 225P Bronze Valve Apart...

COMPARE IT PIECE BY PIECE

It will pay you to look inside the Walworth No. 225P. Compare the improved design, construction and convenience features shown in the "exploded" view. Notice the husky bronze body, the removable seat and disc, the oversize stem, all assuring maximum protection against wear and leakage.

Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell — hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular 82.

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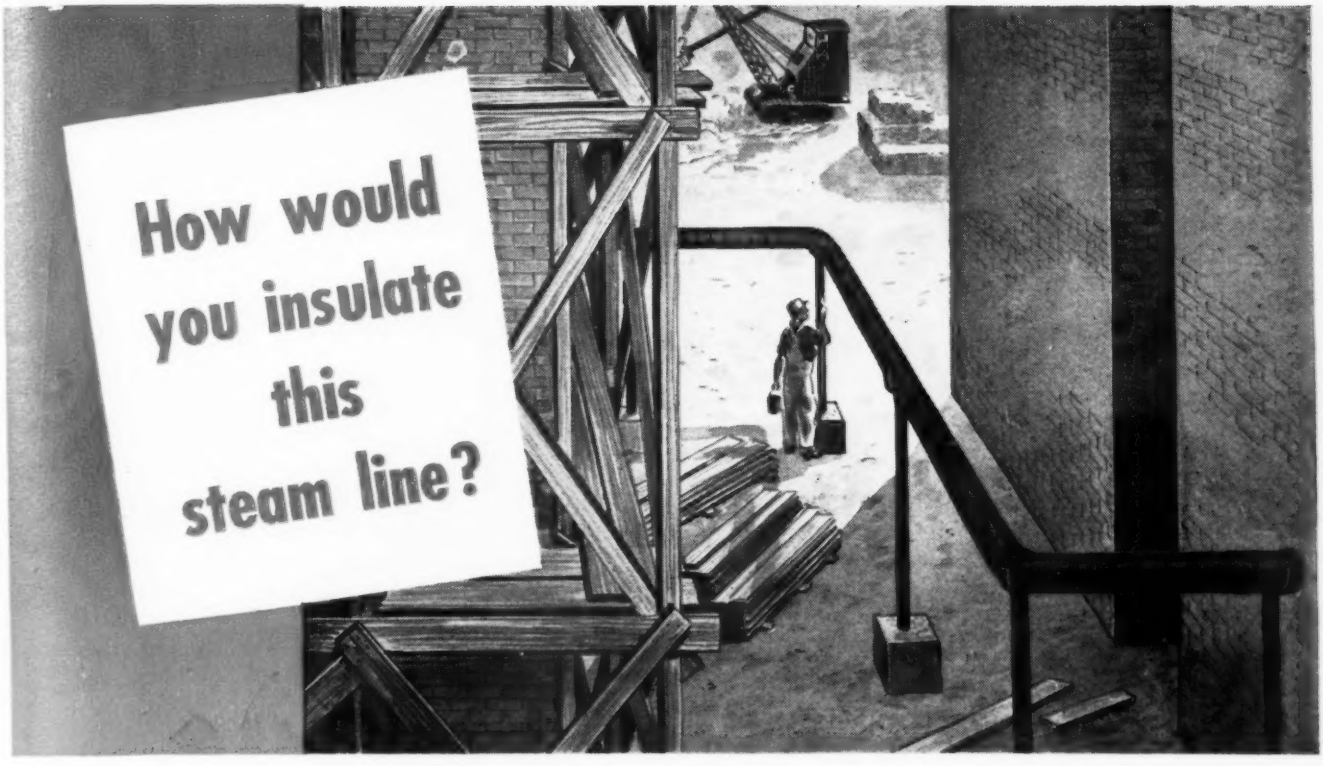
valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



HERE'S THE PROBLEM: A 3″ line carrying steam at 100 lbs. pressure must be installed and operated before a building is erected around it. The line will operate outdoors during the winter months in a locality where continuous periods of zero degree weather are common. The insulation must have an outdoor weatherproof finish, but a painted canvas indoor finish is desired when the building is completed. Which method would you use?

☐ Standard thick 85% Magnesia and roofing paper

☐ 2″ thick 85% Magnesia and roofing paper

☐ Standard thick 85% Magnesia, 1″ hair felt, and roofing paper

Here's what the Armstrong Engineer recommended:

Standard thick 85% Magnesia would be sufficient insulation for this line indoors, but extra insulation was needed when the line was exposed to the zero temperatures prevalent in the locality.

Even 1½″ Magnesia would not have provided enough extra insulation. 2″ thickness, while it would have furnished the extra insulating efficiency required, would have been expensive and would have crowded other lines to be run later.

The Armstrong engineer recommended standard thick 85% Magnesia with pasted canvas jacket, wrapped with a layer of 1″ hair felt for extra insulating efficiency. The entire line was then wrapped with roofing paper, wired in place. After the building was completed, the roofing paper and hair felt were removed and the canvas finish was painted. The hair felt was salvaged and used elsewhere in the plant.

Armstrong engineers have found that every job offers its own special problems, as well as opportunities for economies and improvements. When you work with Armstrong's Contract Service, the insulation specification is written for your special needs—it's filled with exactly the materials your job requires—and it's installed by skilled craftsmen. The entire Armstrong organization takes responsibility.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write to Armstrong Cork Company, Industrial Insulation Department, 7008 Maple Ave., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

EXIDE BATTERIES... as dependable as the Diesel Engines they crank

Exide Batteries have the *extra power* required to deliver the *extra speed* that Diesel engine cranking demands. They are ruggedly built to withstand the rigors of all climates and to assure trustworthy performance in all types of service... even where operating conditions are exceptionally severe.

Exide Batteries are cranking Diesel-powered trucks, buses and off-the-highway equipment. They are giving a good account of themselves in Diesel-electric locomotives, on ships, in power plants and many other applications. And wherever used, Exide Batteries are serving with dependability, long life and ease of maintenance.

Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Diesel Cranking Batteries.

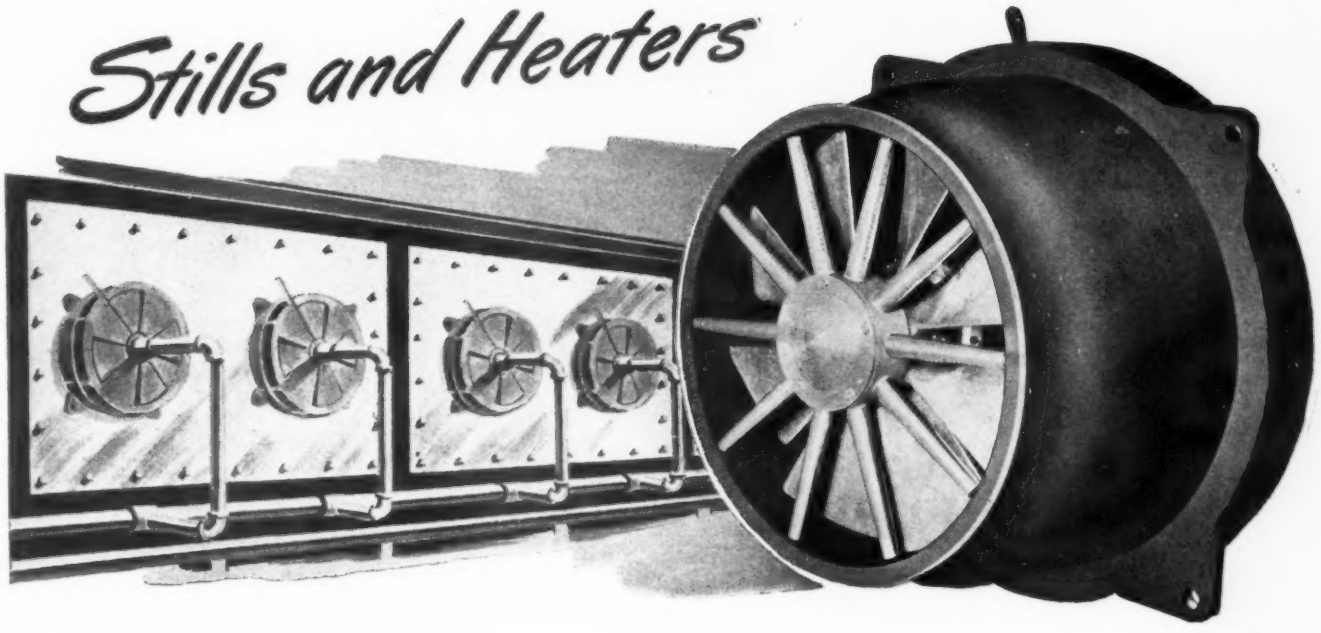
Exide
BATTERIES

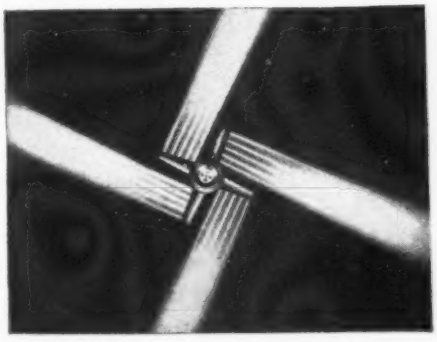
POWER

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

"BUNSEN'S DREAM" UPS THRU-PUT OF

Stills and Heaters





Bunsen, developer of the first gas burner, believed that "An ideal gas burner is one in which there would be an infinite number of gas orifices interposed across the air stream." And that is as close a description as you could get of the Coppus-Dennis FANMIX Burner.

The exclusive "pinwheel action" principle of FANMIX produces a perfectly combustible mixture of air and gas that results in:—

1. Complete combustion with less than 5% excess air.
2. Greater heat release.
3. Total absence of drifting "hot spots"

Here's how FANMIX works. Fuel escaping from orifices in rotating driver arms, rotates the fan which draws in air at right angles to the path of the fuel. The energy of the fuel under pressure is utilized to perform work by mechanically mixing and proportioning the fuel with just the required amount of air.

Increase Rating of Old or New Equipment

Coppus engineers FANMIX Burners for individual application. Complete control over rate of combustion or flame pattern can be provided to meet requirements of any installation. Straight gas and combination gas-oil burners available; combination burners burn either oil or gas in entirety or in any proportion. No oil guns needed.

Send for the Coppus-Dennis FANMIX Bulletin 410-4. Coppus Engineering Corporation, 168 Park Ave., Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

On New Installations, Fanmix Saves

1. **COMBUSTION SPACE.** With FANMIX the furnace does not have to serve as a mixing chamber.
2. **STACK HEIGHT.** With FANMIX there is no draft loss across the burner.
3. **INSTALLATION COSTS.** With FANMIX you can use smaller pipe sizes, need no forced draft equipment, etc.

More than 93% of 191 petroleum refinery plants built for war, use Coppus equipment.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
168 Park Ave.,
Worcester 2, Mass.

Please send Bulletin 410-4 to FREE BULLETIN

Name.....

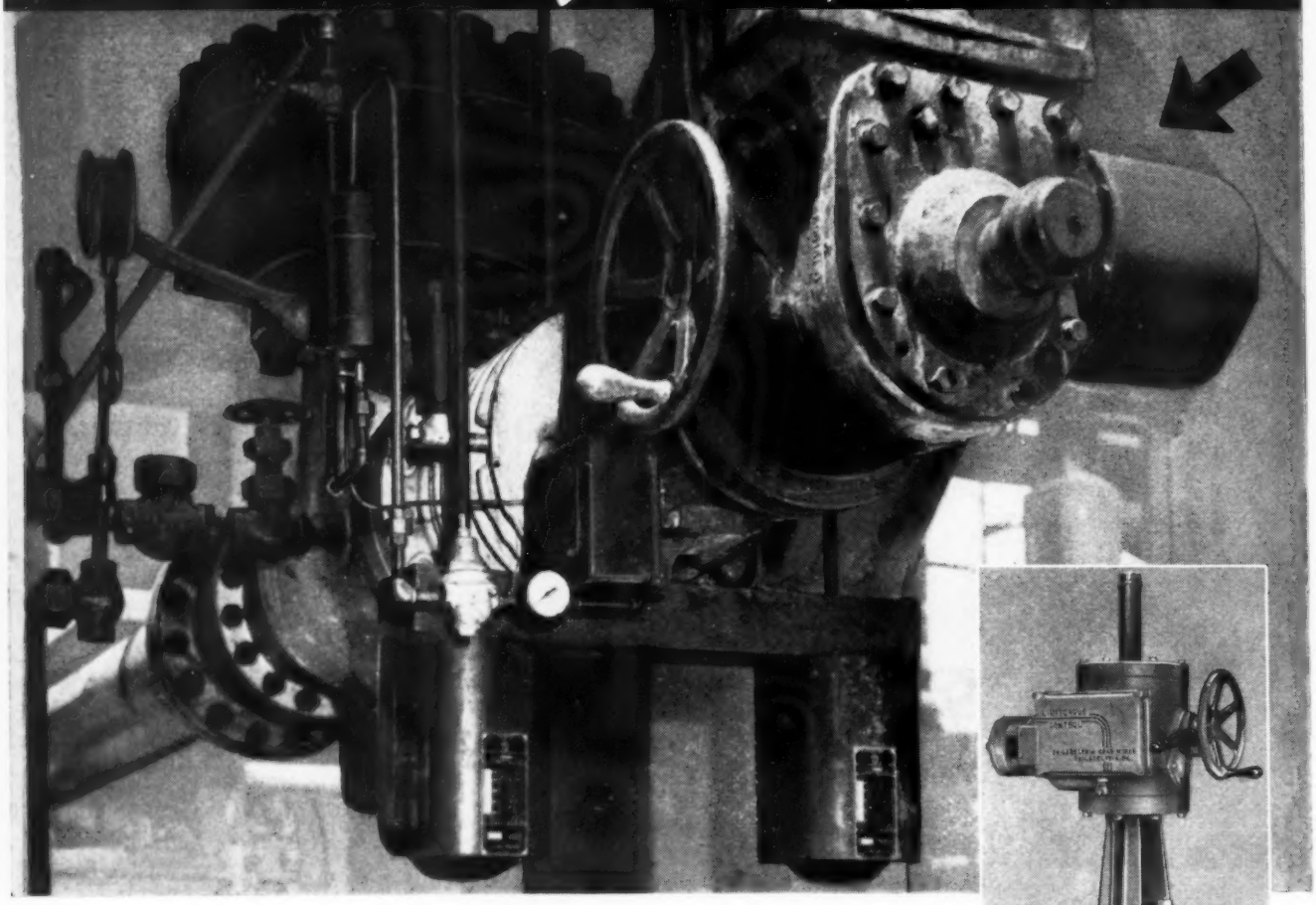
Company.....

Address.....

. . . and in a far-off Mexico City Refinery

"LIMITORQUE" MOTOR OPERATED VALVE CONTROLS

are in successful, daily operation



The above illustration shows one of our Type "S" Limitorque Valve Operators, installed on a "Mason-Neilan" Angle Control Valve, at the Atzcapotzalco Refinery of the Petroleos Mexicanos Co. This installation is but one of hundreds upon hundreds of "Limitorques" in refineries throughout America, and in fact, the World.

Limitorque works upon the "push of a button" and not only assures positive, easy, money-saving valve operation, but absolutely prevents damage to valve discs, stems or seats.

Send for complete Catalog—and please use your business letterhead when writing for same.

The word "LimiTorque" has a definite meaning because an exclusive patented Torque Switch actually limits the torque applied to the operating parts.

FEATURES OF THE TYPE "S" LIMITORQUE

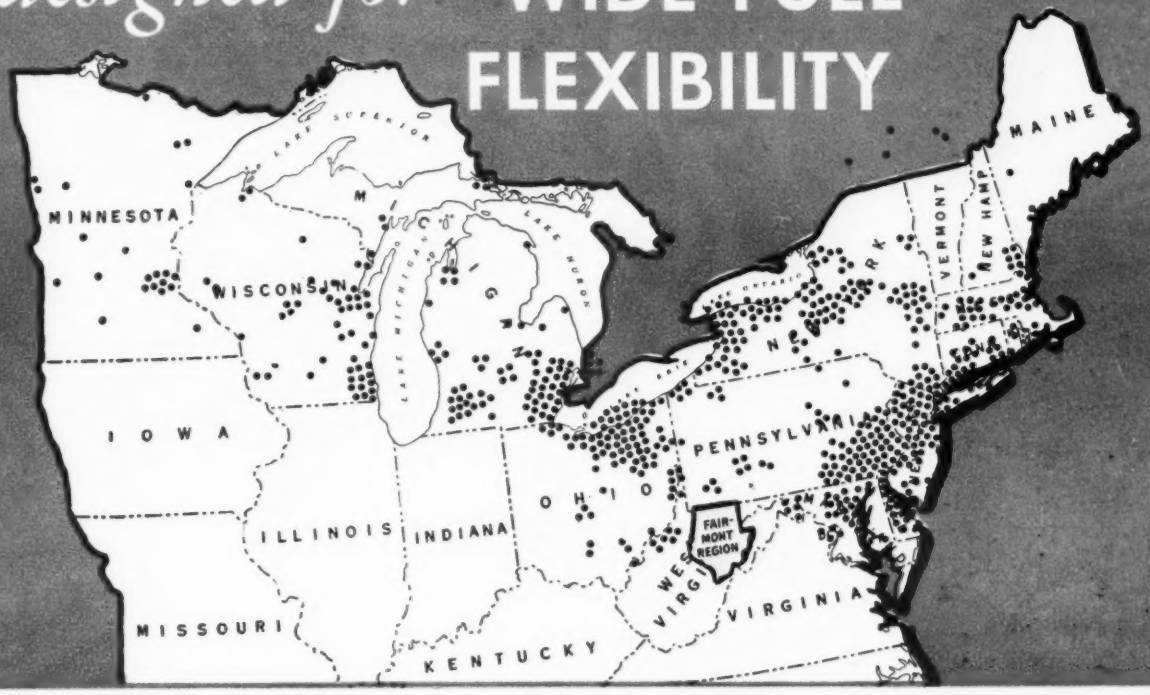
1. Micrometer torque seating switch.
2. Self-contained unit—no gears; nut or bearings to buy.
3. Weatherproof, dust-tight and water-tight construction.
4. Hammerblow device.
5. Non-rotating handwheel built into the unit.
6. Automatic declutching.
7. One terminal board for all electrical connections.
8. High torque motors.
9. Simple valve yoke.

Philadelphia
GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

600 NEW STEAM GENERATORS *designed for* WIDE FUEL FLEXIBILITY



JAN. 1944 • JUNE 1947 • INCLUSIVE

600 NEW STEAM GENERATORS IN FAIRMONT MARKET AREA

81,000,000 LBS. STEAM CAPACITY **27,000,000 TONS ANNUAL COAL CONSUMPTION**

A NEW ERA IN POWER PLANT DESIGN

These modern postwar units ranging in size from 10,000 to 1,000,000 pounds of steam per hour were designed from the ground up for WIDE FUEL FLEXIBILITY.

To protect against any contingency of normal and abnormal coal supply, practically all these modern installations were designed to conform to the following basic maximum and minimum fuel specifications. *These specifications are not actual coal analyses.* Instead, they are tolerance values, which provide factors of safety to assure high capacity, troublefree, economical operation with a wide range of coals.

Maximum Moisture	10%
Maximum Volatile	38%
Maximum Ash	12%
Maximum Sulphur	3.5%
Minimum Grindability (Hardgrove)	50
Minimum Ash-Softening Temperature	2000 F

As a result, furnaces were designed with sufficient volume and watercooling so that (furnace) exit-gas temperature will not exceed ash-fusion temperature *on the oxidizing basis.* Likewise the units have ample pulverizer capacity, or stoker grate area, to insure adequate fuel flexibility.

HERE ARE 600 STEAM GENERATORS... MASTERPIECES OF GOOD DESIGN

FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.
Write for Reference Bulletin No. 10 for more complete information on these 600 installations.
Your request will automatically put your name on the Bureau's mailing list. P—8-47

Name_____ Position_____

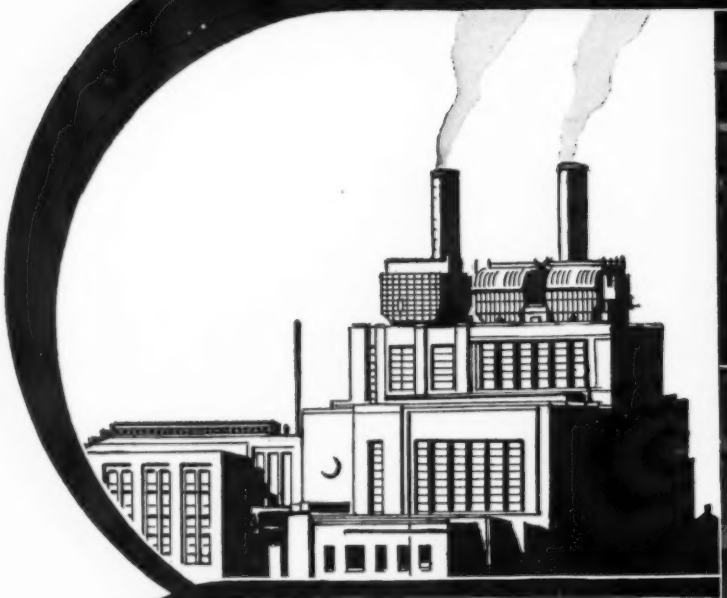
Company_____

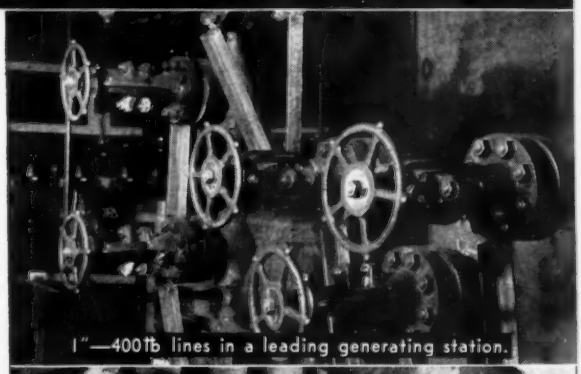
Street Address_____ City_____ Zone____ State_____

FAIRMONT REGION · WEST VIRGINIA · SERVICE TO INDUSTRY

SPECIFY Vogt

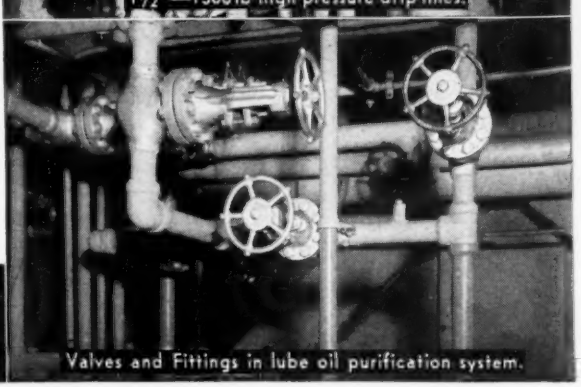
DROP FORGED STEEL
VALVES, FITTINGS & FLANGES
FOR
STEAM GENERATING PLANTS





1"—400lb lines in a leading generating station.

1½"—1500lb high pressure drip lines.



Valves and Fittings in lube oil purification system.

SAFE and SURE control of vapors and liquids at high pressures and high temperatures in modern steam generating plants is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop forged steel* Valves, Fittings, and Flanges made by Vogt play a vital part in the smooth, efficient operations of leading power plants.

Catalog F-8 is the drop forged steel Valves and Fittings Blue Book.

HENRY VOGT MACHINE CO., INC.
LOUISVILLE 10, KY.
Branch Offices: New York • Philadelphia • Cleveland • Chicago • Dallas

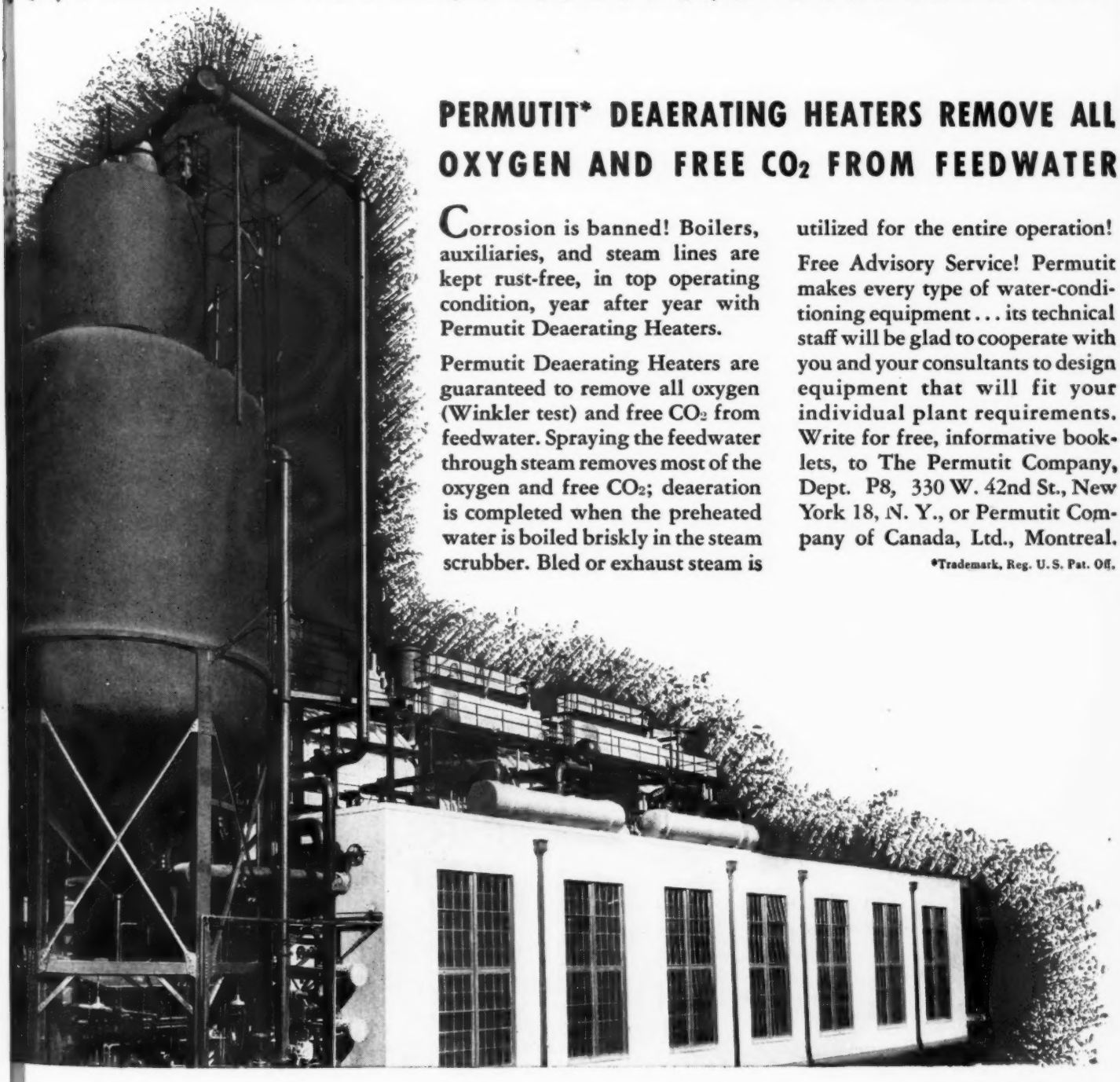
PERMUTIT* DEAERATING HEATERS REMOVE ALL OXYGEN AND FREE CO_2 FROM FEEDWATER

Corrosion is banned! Boilers, auxiliaries, and steam lines are kept rust-free, in top operating condition, year after year with Permutit Deaerating Heaters.

Permutit Deaerating Heaters are guaranteed to remove all oxygen (Winkler test) and free CO_2 from feedwater. Spraying the feedwater through steam removes most of the oxygen and free CO_2; deaeration is completed when the preheated water is boiled briskly in the steam scrubber. Bled or exhaust steam is utilized for the entire operation!

Free Advisory Service! Permutit makes every type of water-conditioning equipment . . . its technical staff will be glad to cooperate with you and your consultants to design equipment that will fit your individual plant requirements. Write for free, informative booklets, to The Permutit Company, Dept. P8, 330 W. 42nd St., New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

*Trademark, Reg. U. S. Pat. Off.

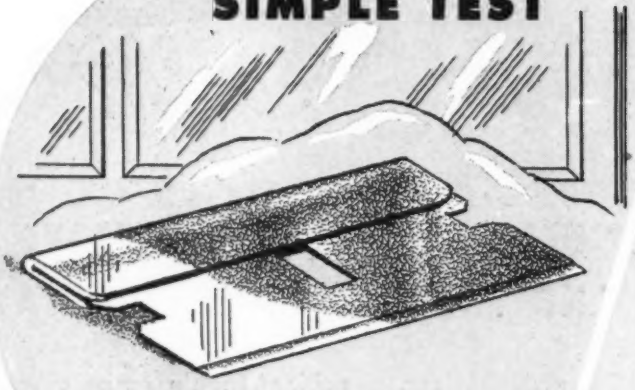


PERMUTIT

WATER CONDITIONING HEADQUARTERS

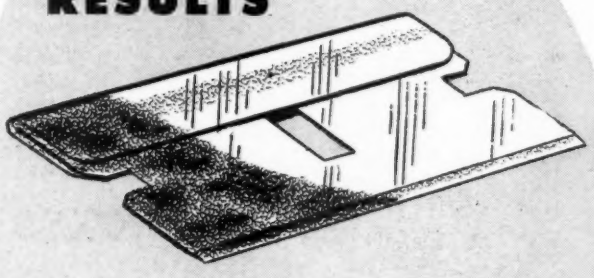
How to PREVENT Corrosion

MAKE THIS SIMPLE TEST



Coat a section of an old razor blade or any piece of raw metal with a protective film of Anti-Corrode. Place it out-of-doors, and leave exposed to the elements.

SEE THE AMAZING RESULTS



Rain, snow, changing temperature, dust and grime have eaten into and oxidized the unprotected metal. But note surface under Anti-Corrode film-bright and unharmed, in its original state.

Cities Service Anti-Corrodes are safe rust and corrosion preventives that bring amazing results. They are reliable safeguards against corrosion of metals in any form or state of finish—whether in storage or in transit. These Anti-Corrodes form a tenacious, durable film that is impervious to moisture and the more common gases prevalent in the atmosphere. And, since they contain lubricating material, they need not be removed in drawing operations. These Anti-Corrodes are made in several types to meet a wide range of service conditions. They are economical, easy to apply and can be removed with kerosene or any petroleum solvent.

(Available only in Cities Service marketing territories EAST of the Rockies.)
Available in one gallon sizes only.

Mail this Coupon Today!

CITIES SERVICE OIL COMPANY
Room 176, Sixty Wall Tower, New York 5, N. Y.

Gentlemen: I would like further information on Anti-Corrode and Rust Remover for industrial use FREE OF CHARGE.

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... **STATE** .....

This TEAM will save you MONEY and MATERIALS

Recently, we announced the development of Cities Service Rust Remover, and the response to our demonstration offer far exceeded expectations. Rust Remover, of course, *removes* rust. Anti-Corrode is designed to *prevent* rust and corrosion. Together, they will safeguard your equipment and production!

CITIES SERVICE

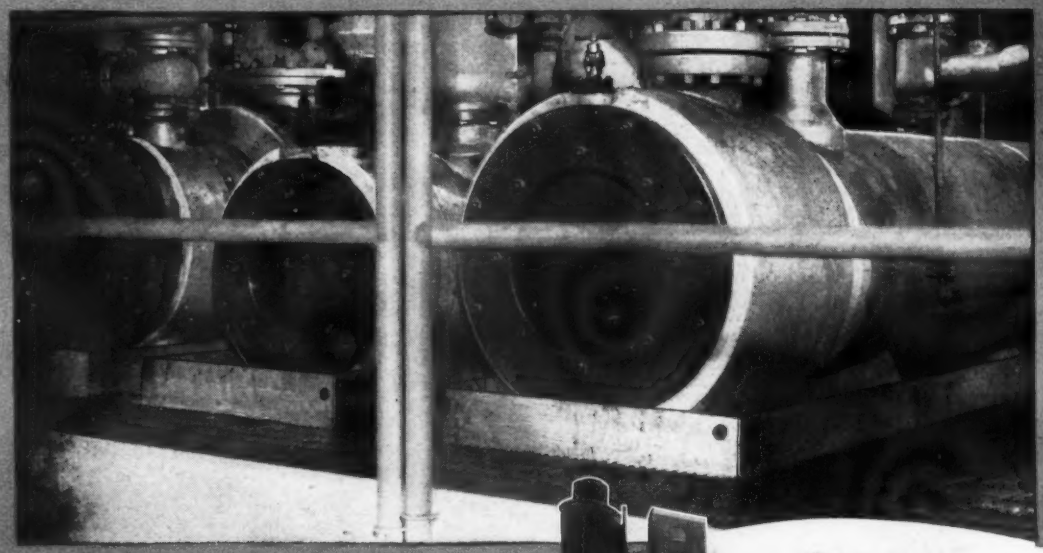
Cities Service Oil Co.
NEW YORK · CHICAGO

Arkansas Fuel Oil Co.
SHREVEPORT, LA.

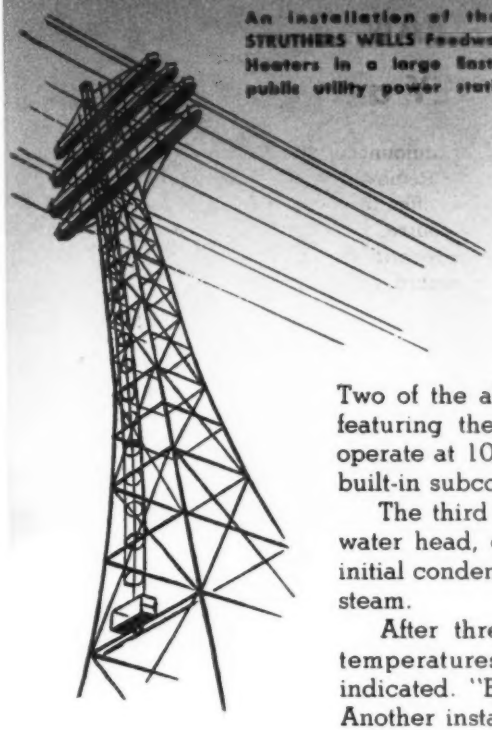
SW STRUTHERS WELLS

Feedwater HEATERS

FOR HIGH PRESSURE SERVICE



An installation of three STRUTHERS WELLS Feedwater Heaters in a large Eastern public utility power station.



Two of the above FEEDWATER HEATERS are high pressure units, featuring the STRUTHERS WELLS' "Boltless Head" closure, and operate at 1000 lbs pressure One of these heaters also includes a built-in subcooling section.

The third unit is a low pressure heater with conventional bolted water head, employing a steam distribution belt to afford sufficient initial condensing surface to most effectively handle the low pressure steam.

After three years of constant service without cleaning, outlet temperatures had only dropped a few degrees, cleaning was indicated. "Boltless Head" closures have been proven trouble-free. Another installation is now being made for the same company at a new plant.

Write for descriptive, technical Bulletin No. B-17.

STRUTHERS WELLS CORPORATION

Process Equipment Division

WARREN, PENNA.

PLANTS AT WARREN, PENNA. AND TITUSVILLE, PENNA.

HERE is a quick-steaming unit expressly designed for maximum output in a limited space. Edge Moor design has combined a simple two-drum boiler bank, having perfect U-tube circulation, and a water-cooled furnace, integral with the boiler. Rapid response to load changes is assured by the great amount of surface exposed to radiant heat. This unit is adaptable to all fuels and is available in all sizes.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today. EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

● Edge Moor Vertical Flow Unit with Edge Moor superheater and air heater fired with continuous discharge spreader stoker. 40,000 lbs. steam per hour, 400 lbs. pressure, 750° F. total steam temperature.

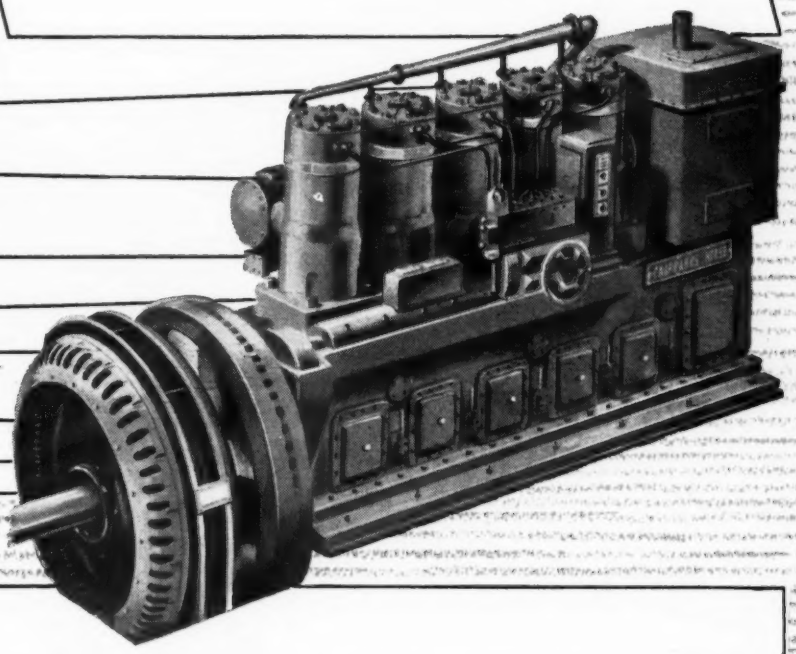
edge moor

steam generating equipment

EM

In Case After Case,

FAIRBANKS-MORSE DIESEL PERFORMANCE IS PROVED



It's the usual thing for Fairbanks-Morse Diesels to turn in consistently outstanding records of performance. Time and again, users in every industrial field report low maintenance, low fuel cost, and dependable operation under sustained, heavy-duty service, with Fairbanks-Morse Diesels.

It is an outstanding combination of diesel performance features—but it is all the more outstanding when you know that Fairbanks-Morse Diesels continue operating this way, year in and year out. Their performance records prove this conclusively.

What Fairbanks-Morse Diesels have done elsewhere, they can do for you, too. Remember—diesels, above all other power sources, deliver the most energy per gallon of fuel oil. Write today for the complete story of Fairbanks-Morse Diesel economies. Fairbanks, Morse & Co., Chicago 5, Illinois.

Fairbanks-Morse

A name worth remembering

Diesel Locomotives
Diesel Engines
Generators • Motors
Pumps • Scales
Magnetos • Stokers
Railroad Motor Cars
and Standpipes
Farm Equipment

INDUCED DRAFT | FORCED DRAFT | NATURAL DRAFT

NO NAILS USED in Water Cooling Zone

"Construction Heart" California Redwood is used in C. H. Wheeler Cooling Towers and to avoid stresses and the danger of wood splitting, no nails are used in the water cooling zone. Cooling surface strips are triangular in shape and seat in notches in horizontal racks, these racks being bolted to vertical supports. Further, no nails are used in the Air Inlet Louvres at the base of the tower or in the Drift Eliminators at the top, these boards being slip fitted into slots. . . . These construction details are big things in assuring long satisfaction and they reflect the benefits you obtain from our fifty years' experience. Send for Bulletin No. 1044.

C. H. WHEELER MFG. CO.
1800 Sedgley Avenue, Phila. 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

Photo of tower below, completed. Outside casing is redwood, but steel, masonry, concrete or transite may be used.

C. H. Wheeler Induced Draft Water Cooling Tower under construction, before end is closed. Note labyrinth of cooling surface strips, which are "not nailed" in position.

C.H. Wheeler

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS
OF PHILADELPHIA

DOWELL

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

How much POWER

—can Dowell chemical cleaning restore for you?

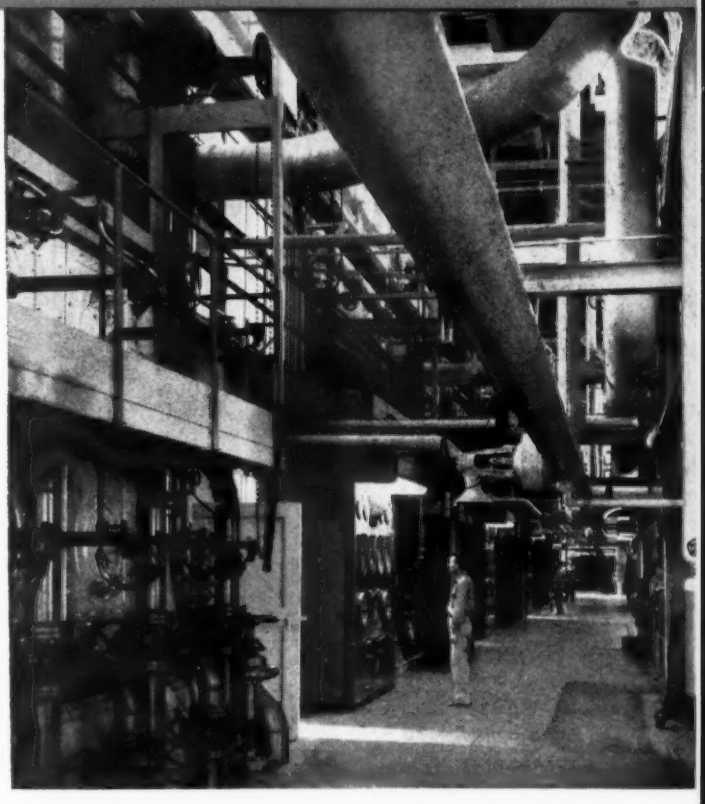


Figure it in dollars and cents: How much power are you losing due to accumulations of scale and sludge in boilers, condensers and other heat-exchange equipment? How much is it costing you for the extra fuel required to overcome the reduced efficiency imposed on your plant by *insulating deposits?*

Take a good look at your designed operating efficiency—and compare it with the *actual output* you are securing. Then call the nearest Dowell office for the facts and figures on *chemical* scale removal service.

Leading plants everywhere rely upon Dowell service—including some of the largest boiler installations in the nation. They tried Dowell service and found it rapid, safe and economical. They've seen Dowell engineers fill plant equipment with liquid solvents designed to dissolve and disintegrate scale and sludge—and they've seen the *results*. You'll make no mistake to follow their example—get the facts.

DOWELL INCORPORATED • TULSA 3, OKLAHOMA

New York, Boston, Philadelphia, Wilmington, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Michigan; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La.

Long Beach, Casper: Dowell Associate—International Cementers, Inc.

Dowell service is supervised by trained engineers using carefully selected liquid solvents and special mobile equipment.

DOWELL

FOR INDUSTRIAL CHEMICAL SERVICE

IN STACKS—
NEW OR OLD

PREVENT CORROSION ...BOOST THE DRAFT

WITH

LUMNITE LININGS

Three 150-ft. Steel Stacks at a large power station. First stack lined with LUMNITE in 1941, second in 1943, third in 1945.

A LUMNITE lining provides thorough protection against the attack of corrosion and heat in a steel stack. It boosts the draft by keeping gas temperature up . . . gives protection from secondary combustion, high-temperature flue gases and overloading. It resists the attack of condensate and sulphurous gases.

The insulating, corrosion-resistant lining is ready for service 24 hours after installation.

FOR OLD STACKS—A LUMNITE lining, shot on with a gun or plastered in place over wire-mesh reinforcement, strengthens the old shell. By providing protection against heat and corrosion, the lining renews the stack for long continued service. The quick lining job gets the stack back at work with minimum time out for reconditioning.

FOR NEW STACKS—A relatively thin lining of LUMNITE heat- and corrosion-resistant concrete will protect the steel indefinitely. The LUMNITE lining placed over mesh reinforcement is jointless, permits no "breathing." Gases or condensate cannot deteriorate the steel. This lining has high structural strength, high heat-resistance and low thermal conductivity.

Write for New Booklet "Concrete Linings in Steel Stacks"

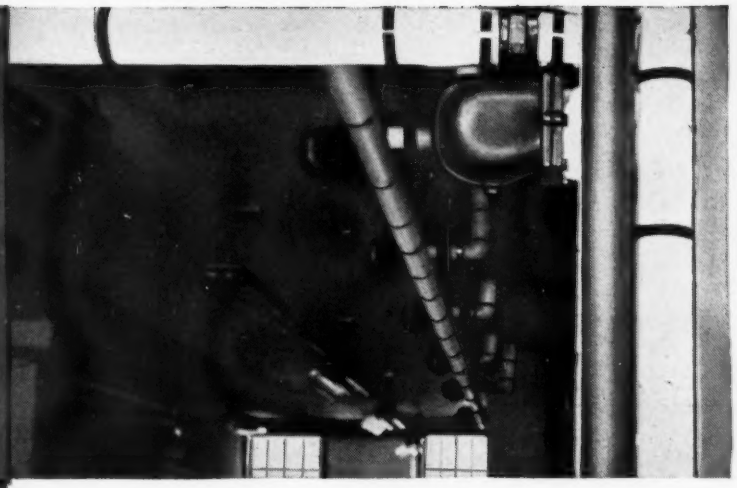
Lumnite Division

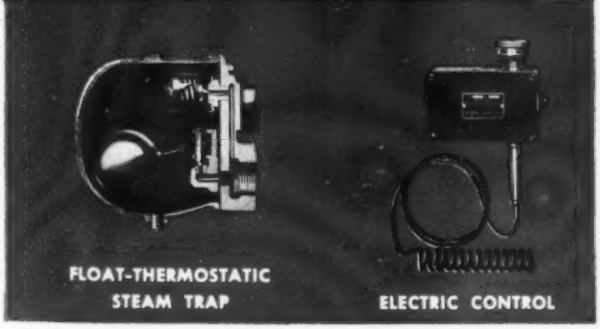
UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL CORPORATION SUBSIDIARY

135 EAST 42nd STREET • NEW YORK 17, N. Y.

THE ONE RIGHT TEMPERATURE





Sarco Float-Thermostatic Steam Traps shown above drain each of the ovens also controlled by the Sarco Electric Controls shown at the left.

In making candles, for instance, if the wax is too cold—it takes more time to remove the finished product from the molds and the edges break off causing a high percentage of rejects. If too hot, the material is discolored or ruined.

After years of unsatisfactory hand control, the plant illustrated now runs like clock-work—with a Sarco Electric Control on each oven, and Sarco Float-Thermostatic Steam Traps on the floor below to drain the coils.

This form of control is less expensive than other methods, and is used extensively in all forms of plating, chemical cookers and food processes. Other Sarco controls are available for out-door and indoor open and closed tanks and for room and duct temperature control.

For any process using steam, there's a combination of Sarco traps and temperature control that will speed production and lower costs. The nearest Sarco representative will show you how.

140

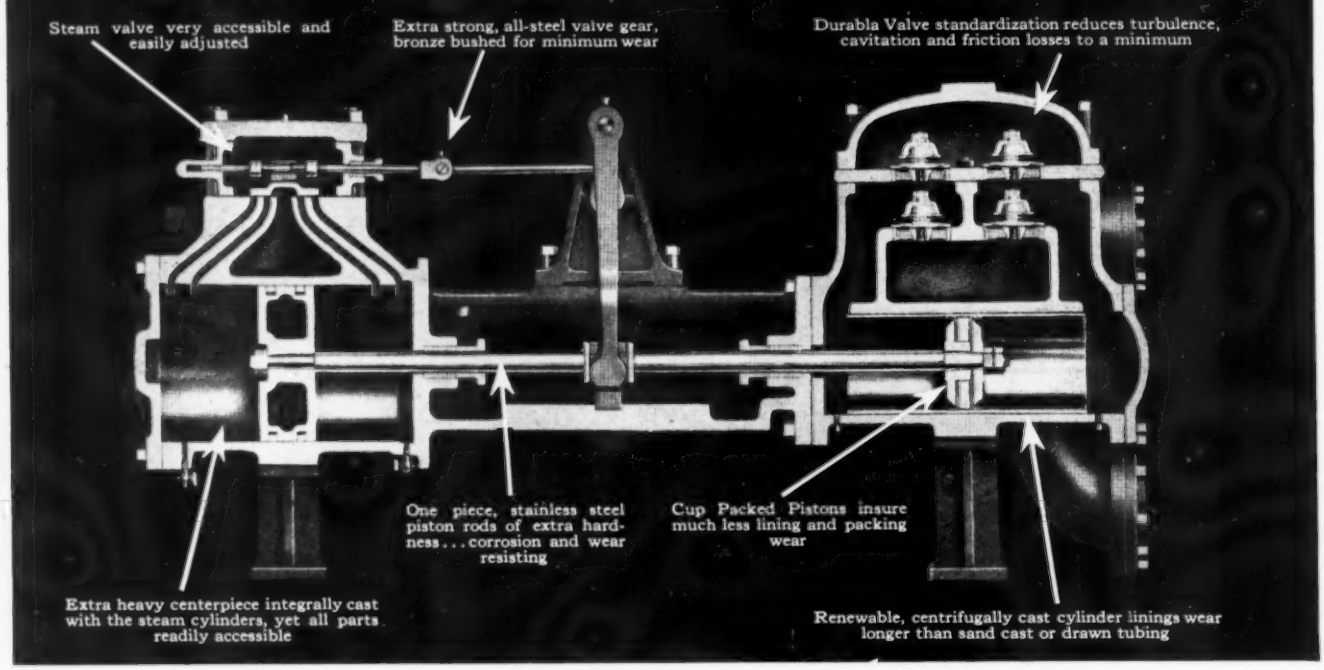
SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
475 FIFTH AVE., NEW YORK 17, N. Y.
SARCO CANADA, LTD., TORONTO 1, ONTARIO

A TYPICAL EXAMPLE OF

Superior Pump Engineering

WARREN REALWEAR STEAM PUMP


Steam valve very accessible and easily adjusted
Extra strong, all-steel valve gear, bronze bushed for minimum wear
Durabla Valve standardization reduces turbulence, cavitation and friction losses to a minimum
One piece, stainless steel piston rods of extra hardness... corrosion and wear resisting
Cup Packed Pistons insure much less lining and packing wear
Extra heavy centerpiece integrally cast with the steam cylinders, yet all parts readily accessible
Renewable, centrifugally cast cylinder linings wear longer than sand cast or drawn tubing

THE Warren "Realwear" is an example of engineering from *your* viewpoint. Notice the plus features in the cutaway view above. Compare with any similar make.

This is the type of engineering that goes into *every* Warren pump—both reciprocating and centrifugal. Dependability, maintained efficiency with low maintenance costs are first considerations. Let us talk with you about your next pumping problem. Write:

WARREN STEAM PUMP COMPANY, INC.
Warren, Massachusetts

Atlanta Boston Chicago Cleveland Denver Detroit Houston
Manchester, Conn. Los Angeles Minneapolis New Orleans New York
Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis

Warren Pumps

CENTRIFUGAL AND RECIPROCATING

P-10

1897 — OUR FIFTIETH ANNIVERSARY — 1947

STEAMASTER is the BOILER WITH PLENTY OF GUTS!

WATER TUBE DESIGN

INCLINED TUBES

SECTIONAL STEEL HEADERS

LONGITUDINAL DRUM

THE GUTS of the Steamaster Boiler

Steam is water plus heat

It is **how** that heat and water are utilized that makes a boiler good or bad. Now take a look at the guts of the Steamaster Boiler — the famed water tube principle, combined with sectional steel headers and inclined tubes gives you a superior design resulting in high thermal efficiency and economical maintenance . . . at no greater cost than an average so-called "packaged" boiler.

Yes... Steamaster Boilers have the guts that enable them to be fired over their rated capacity with no loss in efficiency — the guts to keep on economically filling your steam requirements year after year.

POWER ENGINEERS AGREE . . . STEAMASTER IS THE BOILER WITH PLENTY OF GUTS!

Steamaster

AUTOMATIC BOILER CO.

Compton at Slauson Ave., Los Angeles 11

SALES AND SERVICE IN ALL PRINCIPAL CITIES

The advantages of a WATER TUBE BOILER designed the Steamaster Way

EASY INSPECTION AND MAINTENANCE Every tube immediately accessible. Just open the heavily insulated access doors.

LARGE COMBUSTION AREA . . . THREE PASS HEAT BAFFLING . . . Gives high thermal efficiency — economical consumption of fuel.

POSITIVE TIDAL CIRCULATION OF WATER Maintains all parts at equal temperature.

CONDENSATE RETURN SYSTEM BUILT-IN as an integral part of all boilers of 60 h.p. and up.

CHOICE OF FUEL — GAS, OIL OR COAL Whatever your fuel requirement is, there is a Steamaster Boiler to fill it. Use Gas, Oil or Coal or any combination.

FULL RANGE OF SIZES from 10 to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.

FULLY EQUIPPED FOR AUTOMATIC OPERATION . . . finest accessories.

A.S.M.E. CODE—NATIONAL BOARD APPROVED . . . Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.

WHEN VALVE CORROSION

is your headache

SEND FOR THIS *NEW* CATALOG

● A copy of this new Aloyco catalog should be in the hands of every man in the process industries who purchases, specifies or maintains valves and fittings handling corrosive solutions. In the 52 pages of this publication there is complete information on all standard Aloyco Valves and Pipe Fittings, including concise descriptions, illustrations, dimensional data and materials of construction in which they are regularly stocked.

Two sections of this catalog, particularly, are extremely important to plant men concerned with corrosive fluid-line problems. One is a special section on alloys and their analyses. Another gives specific recommendations of valve materials for use with nearly four hundred different corrosive media. Several pages of photographs are also included showing Aloyco Valves in actual service in chemical, petroleum refining, paper making and other industries.

Write today on your company letterhead for your personal copy of this new Aloyco catalog.

ALOYCO

STAINLESS STEEL VALVES AND FITTINGS

GATE, GLOBE, Y, CHECK, TANK, SAMPLING AND V-PORT VALVES
SCREWED AND FLANGED FITTINGS

ALLOY STEEL PRODUCTS COMPANY, INC.

1493 WEST ELIZABETH AVE. • LINDEN, N. J.

This NEW Veelos Catalog is Crammed with V-Belt Benefits for You

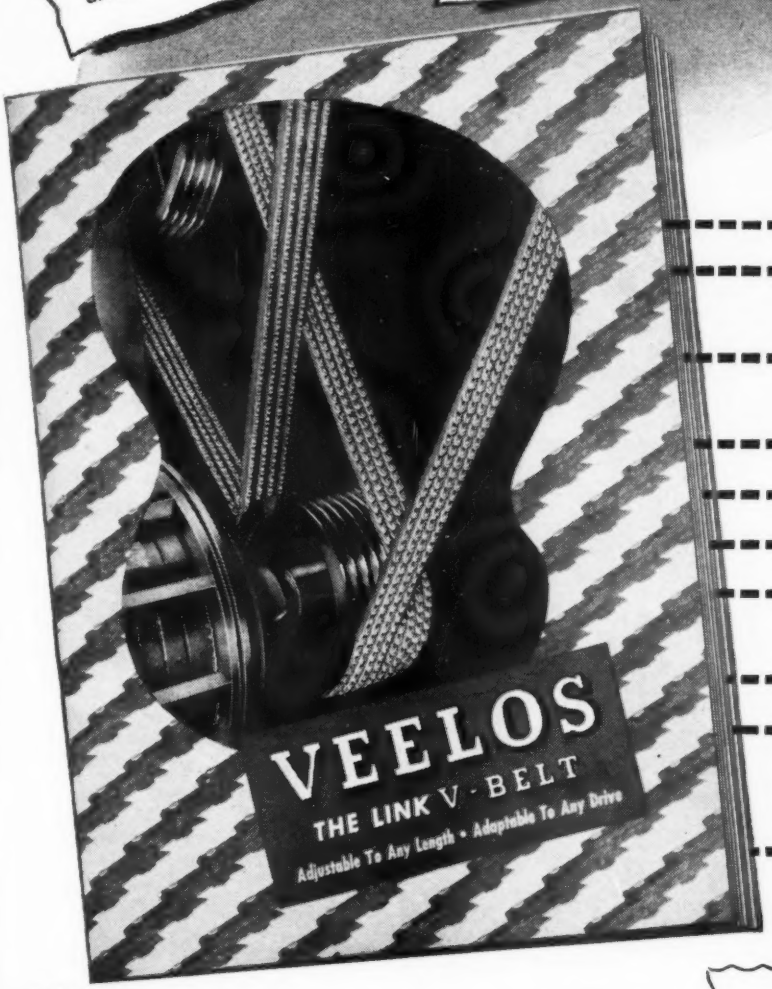
Here are just a few...

Insurance Against Shutdowns
Belt replacements for any length drive are always available from a reel of Veelos.

Expensive Belt Inventories Ended
Four reels of Veelos replace up to 316 sizes of endless V-Belts. Veelos takes up only trifling storage space . . . simplifies stock records.

Costs Far Less to Install
Belts are quickly uncoupled, made endless and installed. Installation savings run as high as 9/10 the cost of installing endless belts.

Easy Adjustability
Uniform tension maintained just by removing one or more links. On fixed center drives, slide rails and pivoted motor bases are not needed.



- 14 Important Advantages *(Page 2)*
- Four Reels replace up to 316 Sizes of Endless V-Belts (*Page 3*)
- Two Types Cover All Drive Requirements (*Page 5*)
- Special Applications (*Page 5*)
- Construction (*Page 6*)
- How to Measure (*Pages 7 and 9*)
- How to Couple and Uncouple (*Page 8*)
- How to Install (*Page 9*)
- Engineering Data: Selection and Length Tables, HP Ratings, etc. (*Pages 10 and 11*)
- Installation Photos of Veelos at Work in a Wide Variety of Industries (*Pages 12 to 24*)

Clip Coupon *for Veelos catalog. The edition is limited but there's a copy for you.*

It's FREE

THIS fact-packed catalog describes in detail 14 distinct advantages of Veelos, the link V-belt. It shows Veelos in action on drives in a wide variety of industries. You will find easy-to-read instructions, applications, installations, engineering data. Send coupon for the book that will bring many benefits to your plant.

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Veelos—Known as VEELINK outside the United States

It Pays its Way
IN THE WORST PLACES!

Hot steel and the processes required to make it a finished product set up just about the worst assortment of conditions wire and cable have to operate under. That's why you'll find Rockbestos A.V.C. *paying its way* in steel mills, foundries — and also in automotive, ceramic, petroleum and food processing industries and others where severe conditions make it tough for power, control and lighting circuits.

For a few of the reasons why Rockbestos A.V.C. *pays its way* in places where other wires carry a short life, read the panel to the right of the cable. Note that the insulation and braid are made of fibres of asbestos, an ageless, non-deteriorating, heat and flame resisting mineral that won't bake brittle, flow, crack or burn. And remember that it withstands operating temperatures up to 230° F. *continuously* and gives you a *plus* in greater current carrying capacity.

To reduce maintenance expense and protect operations, wire your worst circuits with Rockbestos A.V.C. or All-Asbestos wires and cables — 125 different types in 300 to 5000 volt ratings — single or multi-conductor, braided, lead sheathed or armored. Write for recommendations.

ROCKBESTOS PRODUCTS CORPORATION
200 Nicoll Street, New Haven 4, Conn.

ROCKBESTOS A.V.C.
The Wire with Permanent Insulation

HERE'S THE "WHY" BEHIND LONGER SERVICE

Rockbestos A.V.C. 600 volt Power Cable and similarly insulated Motor Lead Cable (N.E. Code Type AVA) have a maximum operating temperature of 110° C., and this failure-preventing construction:

- Tough, age-resistant, impregnated asbestos braid resists heat, flame, moisture, grease, oil and corrosive fumes.
- Outer wall of heat, flame and moisture resistant impregnated felted asbestos won't dry out, flow, rot or burn.
- Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.
- Inner wall of impregnated felted asbestos withstands conductor-heating overloads and won't bake brittle or burn.
- Conductor is perfectly and permanently centered in helically applied non-flowing heat, flame and moisture resisting insulation.

One of 125 different constructions designed by Rockbestos for severe operating conditions in ratings up to 5000 volts.

NEW YORK BUFFALO CLEVELAND PITTSBURGH DETROIT CHICAGO ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

One basic change has

REVOLUTIONIZED ZEOLITE WATER SOFTENING

Elgin alone has the "Double-Check" system

Here's what the new Elgin means to you-

Most plants need more soft water—

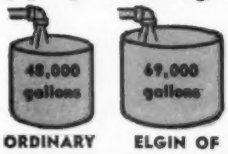
Too often the use of soft water begins and ends in the boiler room. But the extra amount of soft water that costs so little more in the big-output Elgin "Double-Check" Softener permits many uses of soft water that are highly profitable through cutting labor costs, improving processes and reducing maintenance costs. Throughout the hot water system, zero-soft water eliminates scale and lime deposits in tanks, heaters and piping, cutting plumbing costs. In all plant cleaning operations it does a better, faster job with a big saving of soap and cleaning compounds. In many plant processes Elgin "zero-soft" water improves the quality of finished products and where jacketed equipment is involved it increases operating efficiency and cuts maintenance cost.

Where corrosion is a problem, Elgin anti-corrosion treatment gives complete protection.

**** Your present softener, regardless of make, can be modernized by Elgin to incorporate the features and advantages of the Elgin "Double-Check" Softener. The new bulletin explains this.***

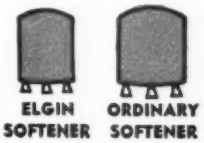
When we say the Elgin "Double-Check"* method has revolutionized the zeolite water softener, we simply state a fact that is confirmed by more than 3,000 of these softeners now in service. Users acclaim it; operating records confirm it! Here briefly is what the "Double-Check" Softener means to you:

(1) Up to 44% more soft water: By preventing escape of zeolite, the "Double-Check" manifold system permits utilizing a zeolite bed far deeper in proportion to the size of the softener. Likewise, by preventing escape of zeolite, a higher back-washing rate is made possible. The zeolite is kept clean and active, thus more zero-soft water is produced per pound of salt. For example, a 48″ x 72″ Elgin, softening ten-grain water, delivered 21,000 gallons more soft water per regeneration than a conventional softener of identical size.



(2) Costs less*—to buy, operate, maintain.* Based on gallons delivered the initial cost of the Elgin is lower. The "Double-Check" distributing and collecting system means less regenerating salt and wash water. Elgin quality means longer life; lower maintenance.

(3) Requires less space. The diagram tells it. This is often a vital consideration.



New bulletin *tells the convincing "Double-Check" story.* State whether you want the general power plant, laundry or hospital edition.

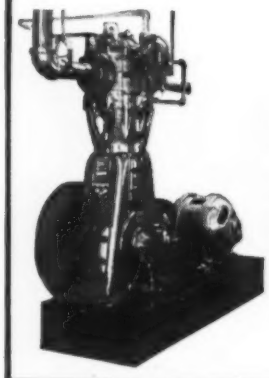
ELGIN SOFTENER CORPORATION

130 NORTH GROVE AVE., ELGIN, ILLINOIS

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

NIGHT AND DAY
SULLIVAN
SERIES 100 - HEAVY DUTY
AIR COMPRESSORS
STAY ON THE JOB!

Trouble-free, 24-hour a day service is typical of powerful, compact Sullivan compressors. Model WN-114 shown here available in four sizes—has four cylinders, 175 to 300 H. P.

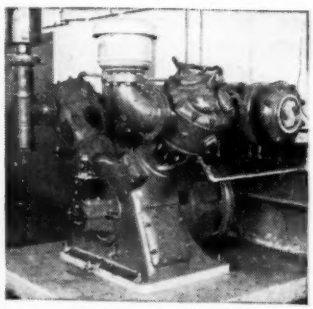


WG-9 AIR COMPRESSOR

Saves space and money

Single stage, double acting, water-cooled, vertical compressor that needs only a simple block foundation. Size with sheave only 3' x 2' 10" x 5' 10" high. Cylinder liners replaceable on job.

WRITE FOR BULLETIN



WN-112 COMPRESSOR

Two cylinder, V-vertical type. Double acting, water-cooled "Dual-Cushion" valves, full force feed lubrication, removable cylinders and crosshead guides. Six sizes—60 to 150 H. P.

WRITE FOR BULLETIN

SULLIVAN DIVISION

JOY MANUFACTURING CO.

GENERAL OFFICES: HENRY W. OLIVER BLDG., PITTSBURGH, PA.

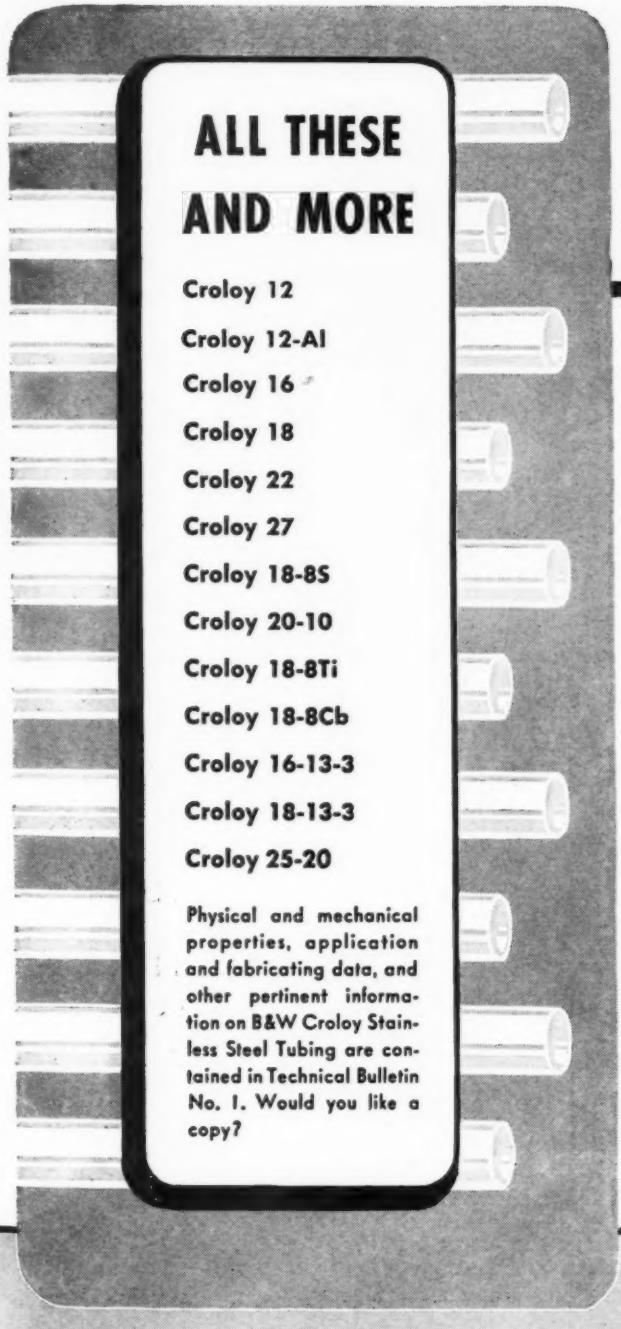
Consult a Joy Engineer

W&D 1-911

Seamless and Welded

STAINLESS STEEL TUBES

. . . all kinds for all purposes from ONE SOURCE



ALL THESE AND MORE

Croloy 12
Croloy 12-Al
Croloy 16
Croloy 18
Croloy 22
Croloy 27
Croloy 18-8S
Croloy 20-10
Croloy 18-8Ti
Croloy 18-8Cb
Croloy 16-13-3
Croloy 18-13-3
Croloy 25-20

Physical and mechanical properties, application and fabricating data, and other pertinent information on B&W Croloy Stainless Steel Tubing are contained in Technical Bulletin No. 1. Would you like a copy?

B&W is the logical place to come for your Stainless Tubing requirements for any kind of pressure, process or mechanical uses for several sound reasons:

...B&W makes BOTH Seamless and Welded Stainless Tubing.

...B&W offers you the widest range and number of ferritic and austenitic analyses available from a single source...many of them available from no other supplier.

...B&W produced the first Stainless Tubing commercially in America; therefore has acquired a wealth of experience and data which users will find helpful in selecting the Stainless analysis best suited for any service condition of corrosion, temperature, pressure, contamination, and for any mechanical use. All B&W Stainless tubing can be furnished in any standard finishes. More information on Croloy Stainless Tubing is available in Bulletin No. 1.

TA-1407S

BABCOCK & WILCOX
SEAMLESS & WELDED TUBES
THE BABCOCK & WILCOX TUBE COMPANY
GENERAL OFFICES: BEAVER FALLS, PA.
PLANTS: BEAVER FALLS, PA. AND ALLIANCE, OHIO.

THROUGH THICK...

...AND THIN!

(*Fitzsimons Viscometer*)

Horatio Alger heroes never struggled harder than do research laboratory technicians today. The intent scientist above is a Sinclair Research technician . . . a skilled specialist at determining how thick or how thin Sinclair lubricating oils must be for specific applications.

With the important Fitzsimons Viscometer, a research measuring apparatus of fine precision, Sinclair Laboratory experts are able to determine with extreme accuracy viscosity characteristics in their studies of lubricants needed to protect your valuable machinery. Precise, accurate flow measurement provides information important in the development of improved products for correct lubrication with light-bodied oils for today's precision-built engines and machinery.

This viscometer is one of several different types with which Sinclair Research goes through thick and thin to assure you of industrial lubricants of proper viscosity. It is typical of the equipment and facilities which are constantly at your service in developing Sinclair lubricants of uniformly high quality to suit your specific application.

Sinclair Power Plant Lubricants
FOR MINIMUM FRICTION—MAXIMUM POWER

For Turbines:
SINTURLITE OILS

For Steam Cylinders:
SINCLAIR STEAM CYLINDER AND VALVE OILS

For Compressors:
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For Ball and Roller Bearings:
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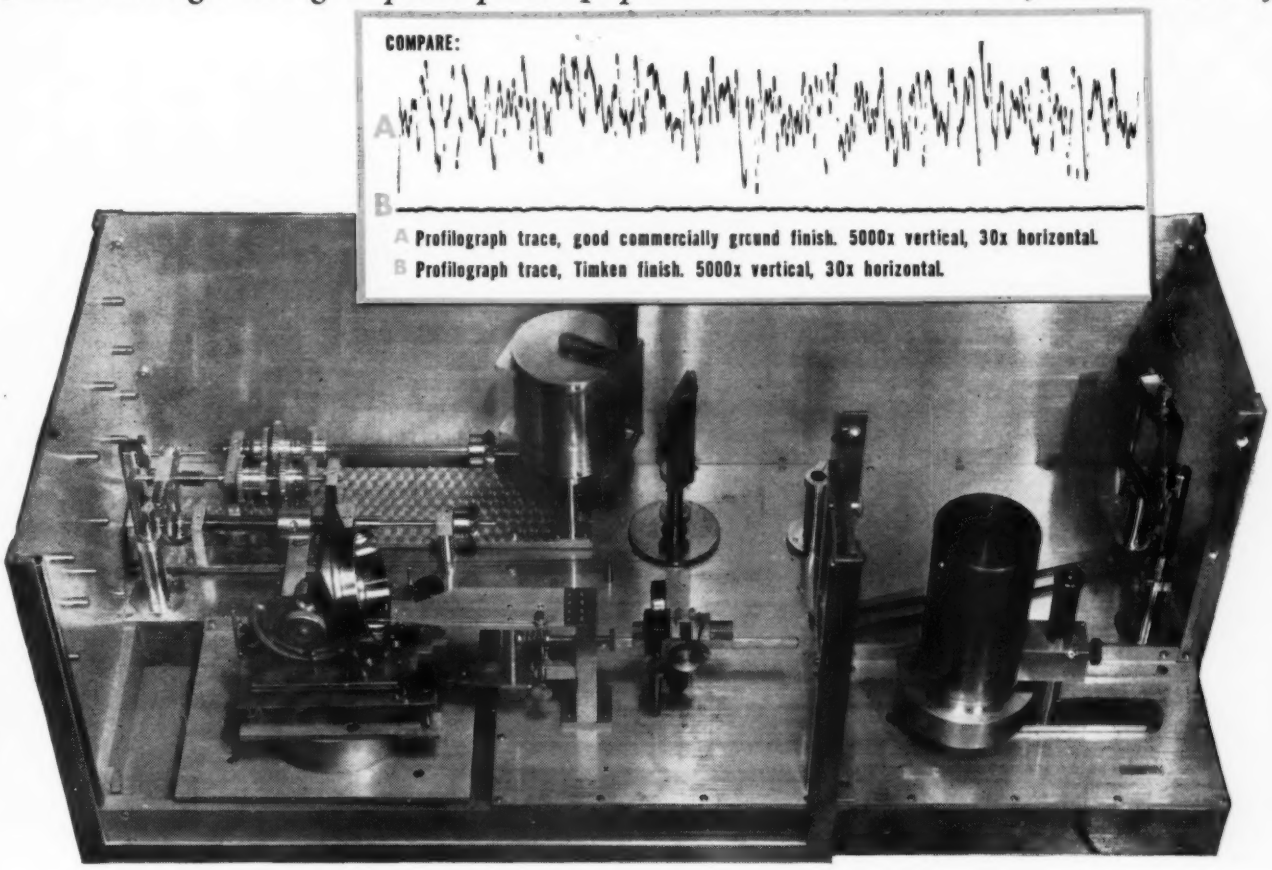
SINCLAIR

Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE

Timken bearings make good power plant equipment better . . . here's one of the reasons why:


COMPARE:
A
B
A Profilograph trace, good commercially ground finish. 5000x vertical, 30x horizontal.
B Profilograph trace, Timken finish. 5000x vertical, 30x horizontal.

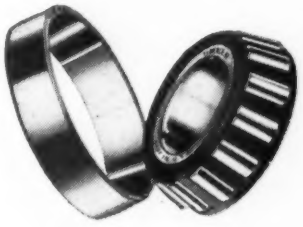
Answers the question— "How rough is smooth?"

ONE of the reasons Timken tapered roller bearings perform with such frictionless, wear-free ease is the amazingly smooth surface finish on the rolls and races —the finest known to modern bearing science.

Now, when you talk about finishes like this, you're talking about surface irregularities of only a few millionths of an inch—irregularities which are impossible to detect by any ordinary means. So, when Timken first began to develop this finish, one of the biggest obstacles was the absence of an accurate method of measuring the roughness of an apparently smooth surface.

The profilograph pictured above was the answer. Developed by Timken in 1928 and steadily improved since then, the profilograph determines surface irregularities to within one-millionth of an inch. Equipped with this measuring stick, Timken engineers were able to develop new finishing methods and machines, which have resulted in the microscopic surface accuracy of the Timken bearings you use today.

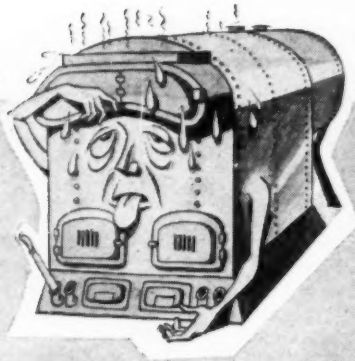
Every factor in the efficiency of a bearing is approached at Timken in this same scientific manner. For example, Timken makes its own steel to assure constant quality. And Timken is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels. No wonder you can always be sure of uniformly top quality and performance in the Timken bearings you use. The Timken Roller Bearing Company, Canton 6, Ohio.

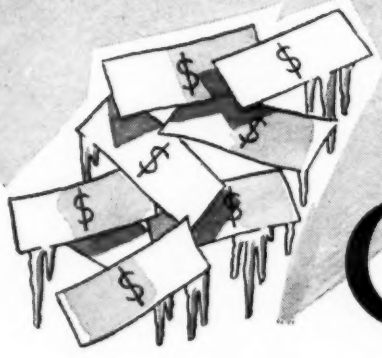


TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST ◎ LOADS OR ANY COMBINATION ◎

hot spots pay off in cold cash





when you insulate with B-H Mono-Block

Send for Sample

On boilers, ovens, furnaces, tanks—wayward BTU's are costing you money. Stop this heat loss with Baldwin-Hill Mono-Block and you earn four extra dividends in the bargain.

DIVIDEND #1—Mono-Block stands up under severe service, up to 1700° F—because it is produced of resilient, heat-resistant fibres of *black* Rockwool.

DIVIDEND #2—Mono-Block has exceptionally high efficiency providing extra insulating protection thanks to the patented felting process used in its manufacture.

DIVIDEND #3—Mono-Block saves time and material—*one block* efficiently serves the full temperature range to 1700° F.

DIVIDEND #4—Mono-Block is easy to install—fits snugly over rivet heads and other irregularities, cuts to shape with a knife where necessary.

The coupon brings descriptive literature and a sample.

Baldwin-Hill Company
514 Breunig Avenue
Trenton 2, N. J.
Send free sample of B-H Mono-Block and data book "Industrial Insulations"

Name..... Position.....

Firm.....

Address.....

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OTHER B-H INSULATION MATERIALS

B-H No. 1 Cement—a fast-covering, rust-inhibited plastic insulation effective to 1800° F. **B-H Blankets**—For wrap-around insulation of large areas, effective to 1200° F. **B-H Weatherseal**—A weatherproof compound for protecting insulated surfaces.

Baldwin-Hill

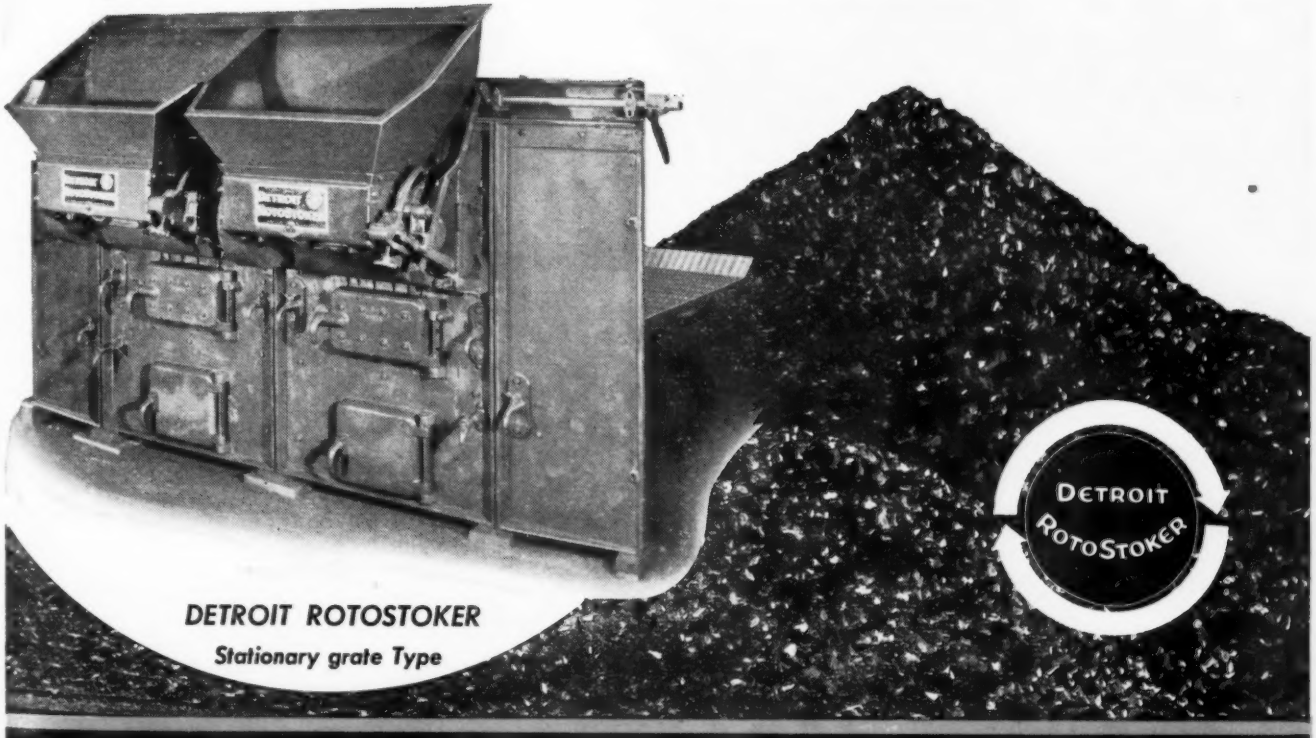
Specialists in Thermal Insulation

THERE'S A ROTOSTOKER IN YOUR COAL PILE

The cost of a new Detroit RotoStoker is in your coal pile today. The savings that can be effected by this *more satisfactory* and *economical* firing method will pay for a RotoStoker. Buy your coal from the most convenient sources because the RotoStoker has a reputation for burning a wide range of fuel. Rapidly fluctuating loads are easily handled.

The Detroit RotoStoker is a spreader stoker with *Overthrow Rotors* that assure *dependable* and *uniform fuel distribution.* Built with stationary, hand dumping or power dumping grates.

Write for Bulletin.



DETROIT ROTOSTOKER
Stationary grate Type

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

District Offices in Principal Cities • Works at Monroe, Michigan

Only Sloan

can say this:

92.5% OF ALL HOSPITALS* ARE SLOAN EQUIPPED—

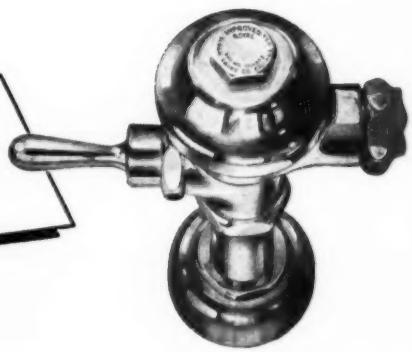
61.3% OF ALL HOSPITALS ARE EXCLUSIVELY SLOAN!

There are several reasons for Sloan's preeminence. For one thing, maintenance costs are reported as low as ¼ of 1c per valve *per year.* Then, too, Sloan Flush Valves save water; they protect public health by preventing back syphonage; they can now be whisper quiet; they have unlimited life—yet cost no more. That is why more Sloan Flush Valves are sold than all other makes combined.

SLOAN VALVE COMPANY • 4300 W. Lake St., Chicago, Ill.

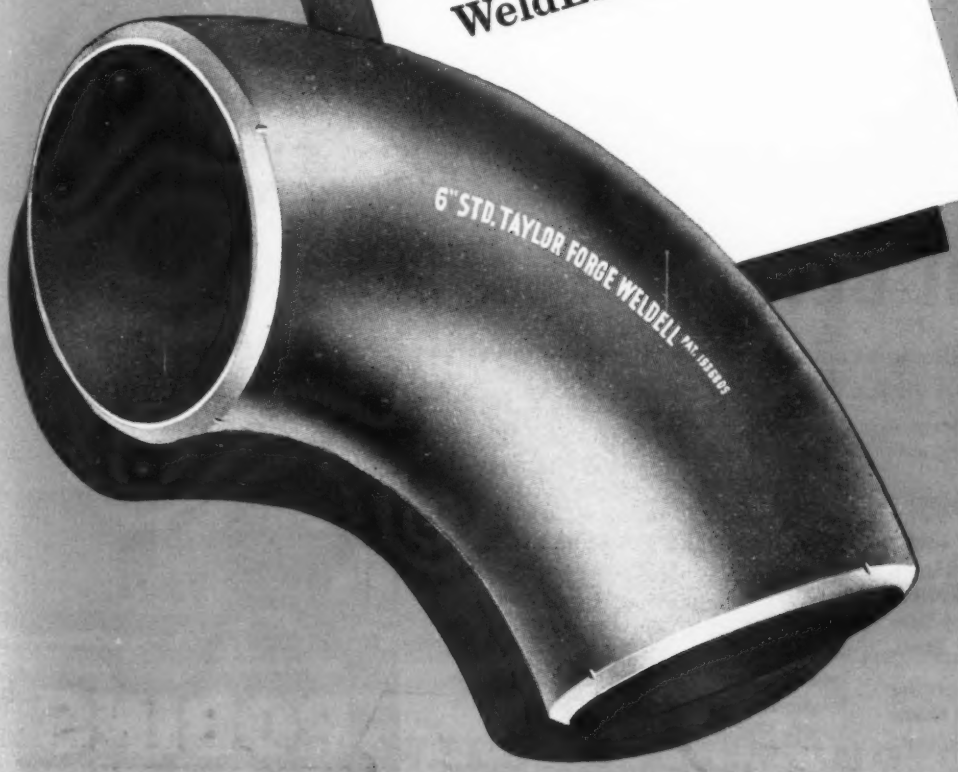
**Hospitals of 100 beds or more.*

sloan *Flush* valves



WeldELLS *have everything**

Only Taylor Forge "know-how" and facilities could give you this combination of plus-value features ..... found only in WeldELLS.



* **WeldELLS alone combine these features:**

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification markings**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

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Shake well before using!

That's right! *Shake* the car. It's the easiest way to empty it.

Ordinarily, unloading your hopper cars is quite a task. And an expensive one, too.

Material that has traveled many miles in hopper cars tends to settle down . . . to pack tightly. It takes a lot of time to loosen it. Often requires as many as six men to empty one car, always at risk to life and limb.

But the new time- and labor-saving way to unload cars is to *shake* them empty with a Robins Car Shakeout.

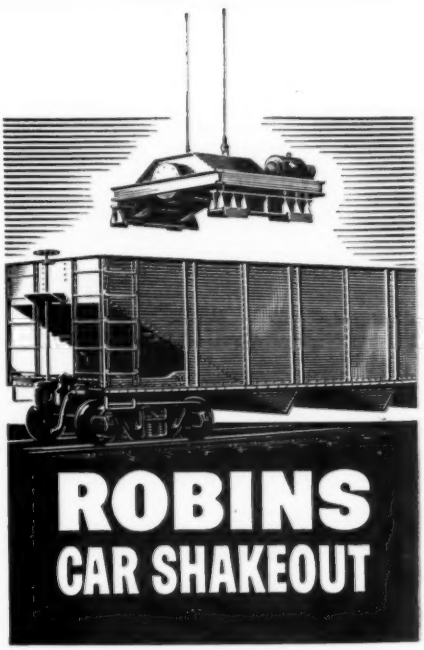
Just lower this portable Shakeout onto your car. Then press a button and the Shakeout does the rest. It loosens the packed or frozen material . . . lets it flow freely and quickly through the hopper doors.

Fifty- or seventy-ton cars are emptied "broom-clean" in as little as 90 seconds. There is no damage to cars. The operator works in complete safety. Hours of labor are saved. Demurrage charges are practically eliminated!

Actual field operations by hundreds of users prove that this new method of unloading hopper cars is as much as twelve times faster than manual unloading.

Write Robins today for details.

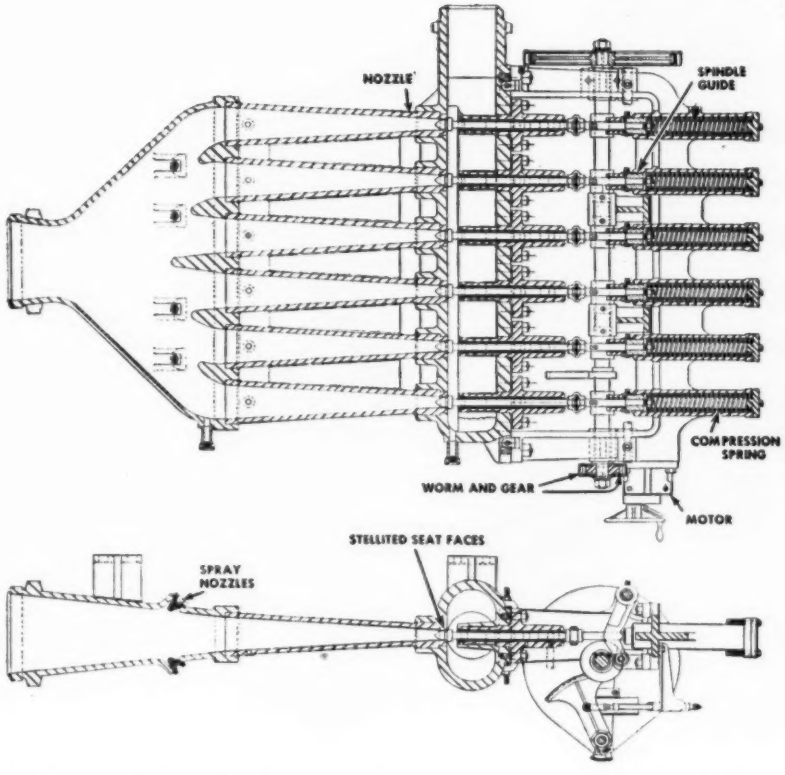
A note on your company letterhead will bring you this new booklet about the Robins Car Shakeout. Tells how this new concept in car unloading saves time, manpower and money.



ROBINS CONVEYORS DIVISION, Hewitt-Robins Incorporated, Passaic, N. J.

an k "reason why"

engineered to bridge a gap



A large public utility had a problem . . .

In bridging a gap . . .
From a high pressure steam source . . .
To low pressure turbines.

An k Reducing and Desuperheating Valve . . .

Bridged the gap . . .
Solved the problem.

In operation, it reduces steam pressure . . .

From 1300 psi gauge to 215 psi gauge . . .
And desuperheats steam . . .
From 950° F.T.T. to 500° F.T.T. . . .
While supplying 1,000,000 pounds per hour.

This Multi-nozzle Reducing, Desuperheating Valve . . .

Performs efficiently . . .
Operates quietly . . .
Regulates accurately . . .
Controls smoothly . . .
Requires little maintenance.

It's an outstanding example . . .

Of Schutte and Koerting's ingenuity . . .
In designing and building a product . . .
To meet a requirement.

SCHUTTE and KOERTING Company

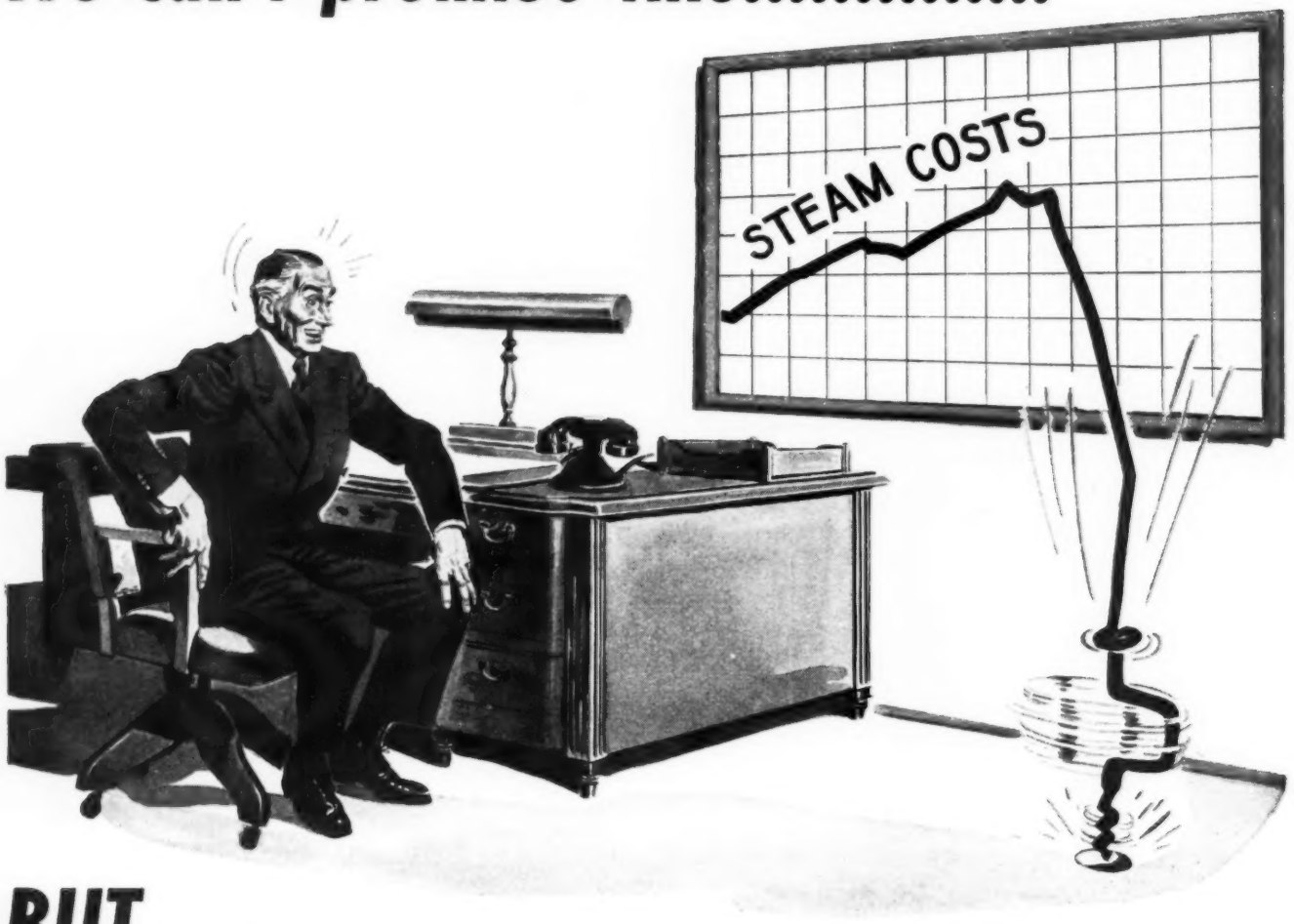
Manufacturing Engineers

1150 THOMPSON STREET • PHILADELPHIA 22, PA.

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS AND FLOW INDICATORS RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS

Schutte & Koerting have always quoted "firm prices" — a principle in good business for all business.

We can't promise this.....



BUT.....

We *can* promise you low steam costs. Savings of as much as 20% can often be realized by replacing a conventional 14-year old boiler with a modern Preferred Unit Steam Generator.

WHY? Because the Preferred packaged power plant is the *only* factory-completed unit steam generator with *all* these money-saving features:

1. Induced (Pull-through) Draft. A distinctive feature which eliminates the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation, even with Bunker C, No. 6, including the new catalytic residuals.

3. Preferred Oil Burner, built especially for this unit.

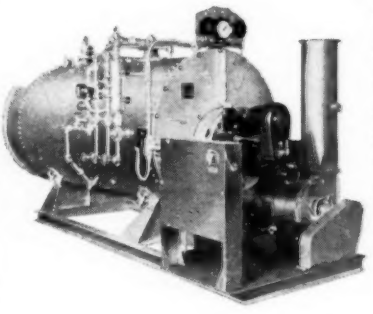
4. Four-Pass Gas Travel results in maximum heat absorption.

5. 80% Thermal Efficiency proved and guaranteed.

6. Low Maintenance, the result of over 27 years of combustion engineering experience.

7. Full Range of Sizes from 40 to 500 hp. and pressures up to 200 lbs. Two-Pass Units in 10, 20, 30 hp. and pressures up to 125 lbs.

These features add up to lower fuel costs, minimum repair bills and the elimination of costly, unexpected shutdowns for those who replace their old boiler with a modern Preferred Unit Steam Generator.



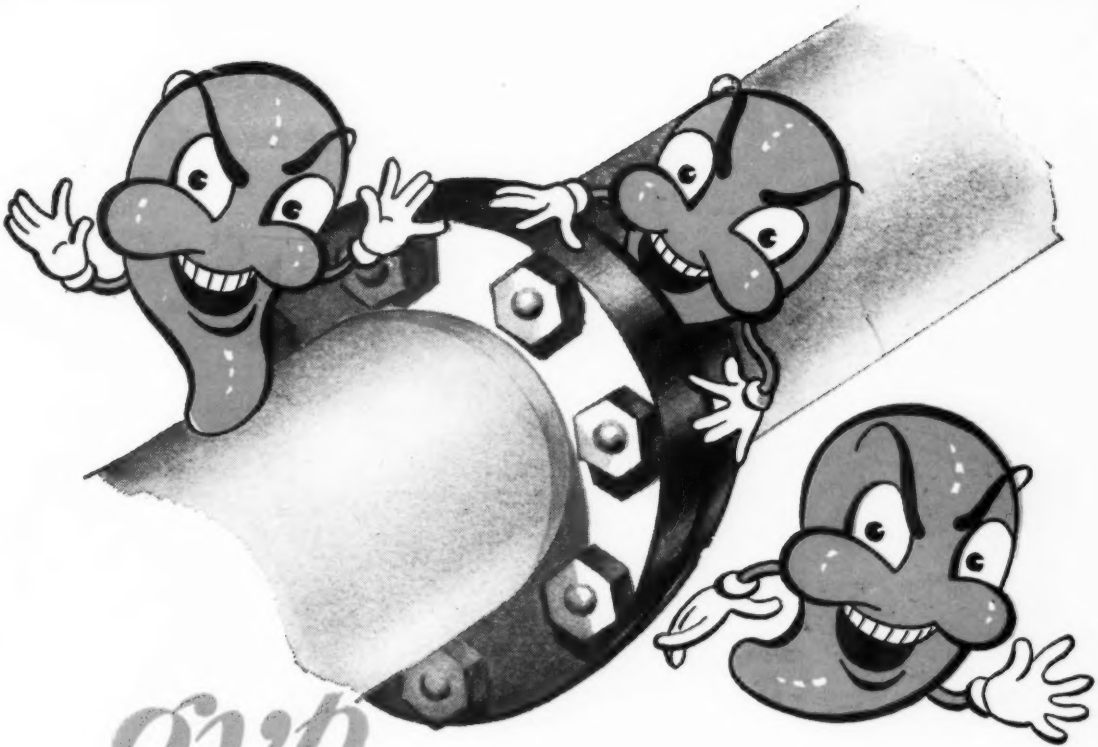
Two Booklets giving the inside story on Preferred steam generation are yours for the asking. *"Dividends From Your Power Plant"* tells the "profit side" of the story in 36 fact-filled pages written especially for management. Bulletin 1000E gives the *engineering* details on these money-saving units.

Send for your copies, today!

P-8-47

PREFERRED UTILITIES MANUFACTURING CORP. 1860 Broadway, New York 23, N. Y.

PREFERRED UTILITIES MFG. CORP.



gyp joint

BTU's escaping from one pair of bare, 10-inch flanges at 350° F. can waste a ton of coal a year. If that isn't a "gyp joint," you name it!

But whatever you call it, it looks just as sour on a cost sheet. Day after day, year after year, inefficient insulation (or *no* insulation) costs industry countless BTU's . . . countless dollars.

YOU CAN CHECK THOSE LOSSES—CUT COSTS . . . by making sure that plant insulation is as efficient as production factors *must* be today. The quick, easy way to do that is to make full use of . . .

CAREY'S COMPLETE INSULATION SERVICE. That includes well 'rounded insulation engineering facilities . . . the know-how for any size job . . . a complete line of insulations for industrial needs, developed by 74 years of experience in serving industry . . . warehouse stocks from coast to coast, to provide prompt, thorough service.

Call **CAREY** for *any* insulation requirement . . . from a survey to a complete installation. You'll get quick action on any request, whether you need help to solve an immediate insulation problem or whether you simply . . .

WRITE FOR YOUR FREE COPY . . . of this helpful booklet. It's an excellent guide to selection of proper insulation, contains specifications and tables you want handy for ready reference. Gives a complete picture of the **CAREY** Heat Insulation line, too. A *free* copy of "Heat Insulation For Industry" is yours for the asking. Address your request to Dept. P-8.

Carey

Industrial Insulation • Rock Wool Insulation
Careyduct • Asbestos Wallboard & Sheathing
Asphalt Shingles & Roofings • Built-up Roofing
Roof Coatings & Cements • Pipeline Felt
Asphalt Tile Flooring • Waterproofing Materials
Expansion Joint • Asbestos Shingles & Siding
Corrugated Asbestos Roofing and Siding
Miami-Carey Bathroom Cabinets & Accessories

THE PHILIP CAREY MANUFACTURING CO., CINCINNATI 15, OHIO

In Canada: The Philip Carey Co., Ltd.
1557 MacKay Street, Montreal 1, P. Q

But It's Just a Pin!

This short length of UNION roller chain is made up of the 28 separate parts shown below.

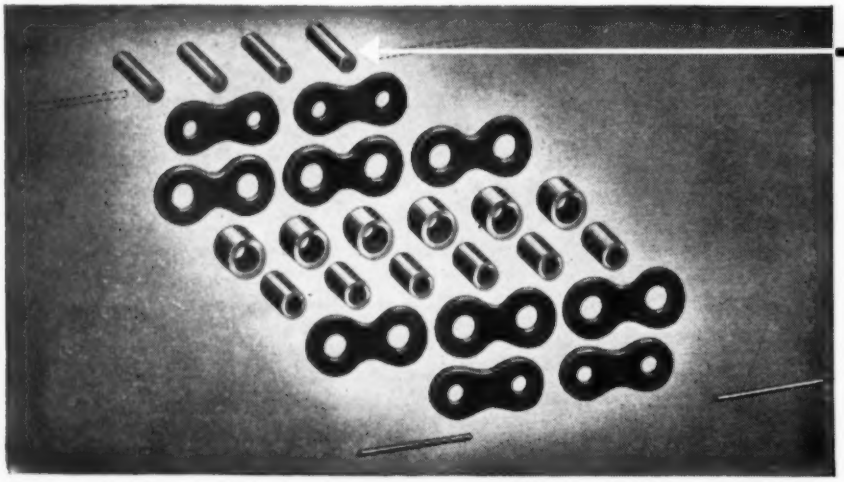
UNION CHAINS

Yes, it's a pin—just a small pin. But it requires 11 distinct and precise operations to make it. For this is a pin for a link of UNION roller chain, and together with the bushings and the rollers it accepts and withstands all the wear that a roller chain is subjected to.

If you will study the "exploded" drawing below you will see that there are 4 of these pins in the short length of UNION roller chain shown at the left. You will also see that there are a total of 28 separate parts in this same length of chain. To make them all, exactly 290 operations are required. And every step from receipt of material to finished product is under the careful supervisory control of an inspection department responsible to the engineering division.

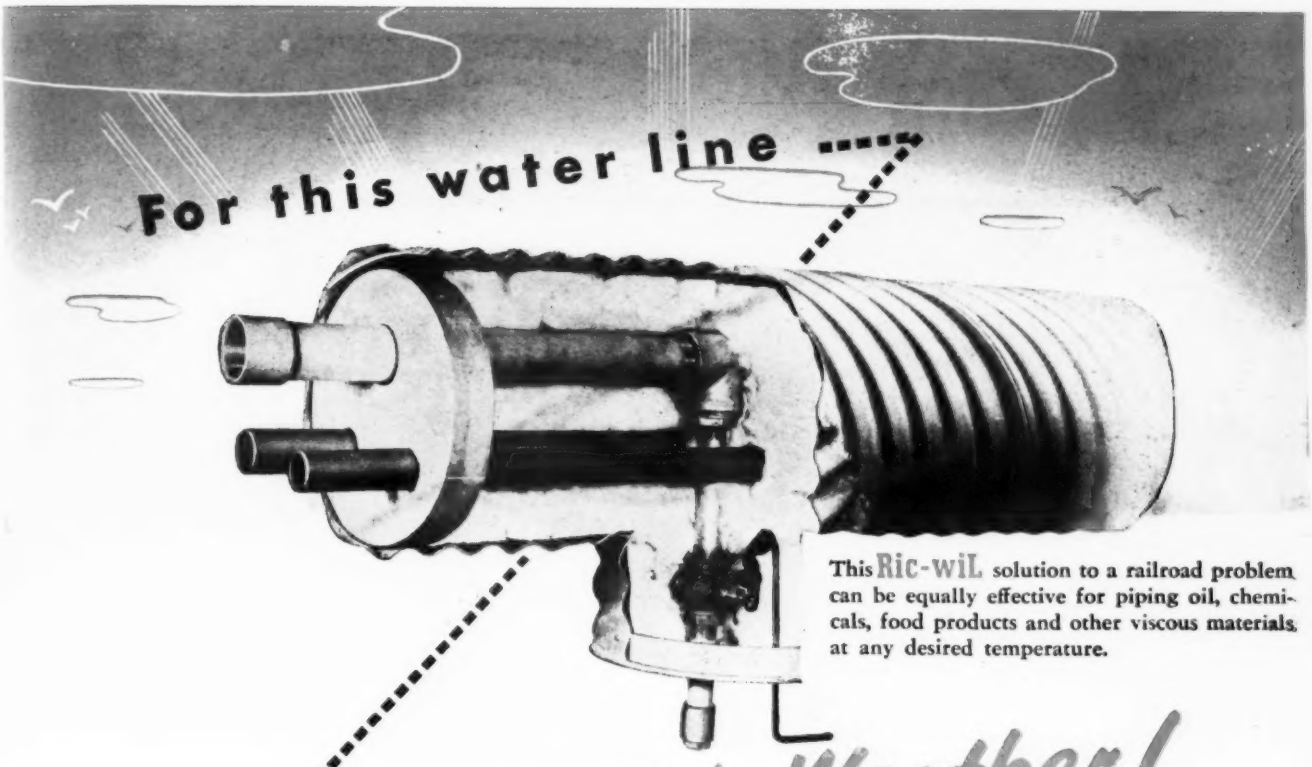
As specialists in the manufacture of sprocket chains, sprockets and attachments (we make nothing else!), we point with some pride to the high standards of skill and precision maintained by our engineers and craftsmen at UNION CHAIN. We are not yet able to meet the overwhelming demand for UNION chain, but we assure our customers and friends that we are making every effort to do so, consistent always with the character of our product and the complicated processes of its manufacture.

The Union Chain and Manufacturing Company • Sandusky, Ohio



THESE 11 OPERATIONS TO MAKE THIS STEEL CHAIN PIN:

1. straighten stock material
2. cut off to length
3. chamfer ends
4. carburize
5. drill for cotter pin hole
6. re-heat and quench
7. re-heat to refine core structure
8. draw to relieve internal strains
9. rough grind
10. finish grind
11. anneal end for riveting



This Ric-wiL solution to a railroad problem can be equally effective for piping oil, chemicals, food products and other viscous materials at any desired temperature.

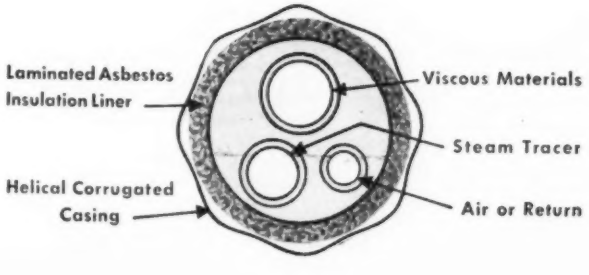
It's ALWAYS Fair Weather!

This overhead line, insulated and protected by Ric-wiL Prefabricated Pipe Units, eliminates the danger of contamination in the service facilities used to supply drinking water to railroad coaches. It is a type designated as preferred by the U. S. Public Health Service as "obviously the safest" since it entirely eliminates ground hydrants equipped with weep holes through which contamination could enter the supply line. Outlet tees are provided, as desired, to replace hydrants.

An insulated steam line paralleling the water supply line in this Ric-wiL Unit provides sufficient heat to prevent the cold water from freezing during long periods of still flow. This arrangement also permits location of the supply line on the surface or underground, with the steam line running through hydrants, precluding the necessity for weep holes.

Additional service piping for compressed air, condensate return or oil, or for similar purposes, may also be located in this same unit housing if desired. Completely assembled in 21 ft. lengths these units provide easy, speedy installation and will withstand repeated handling so that the system can be dismantled and relocated if desired.

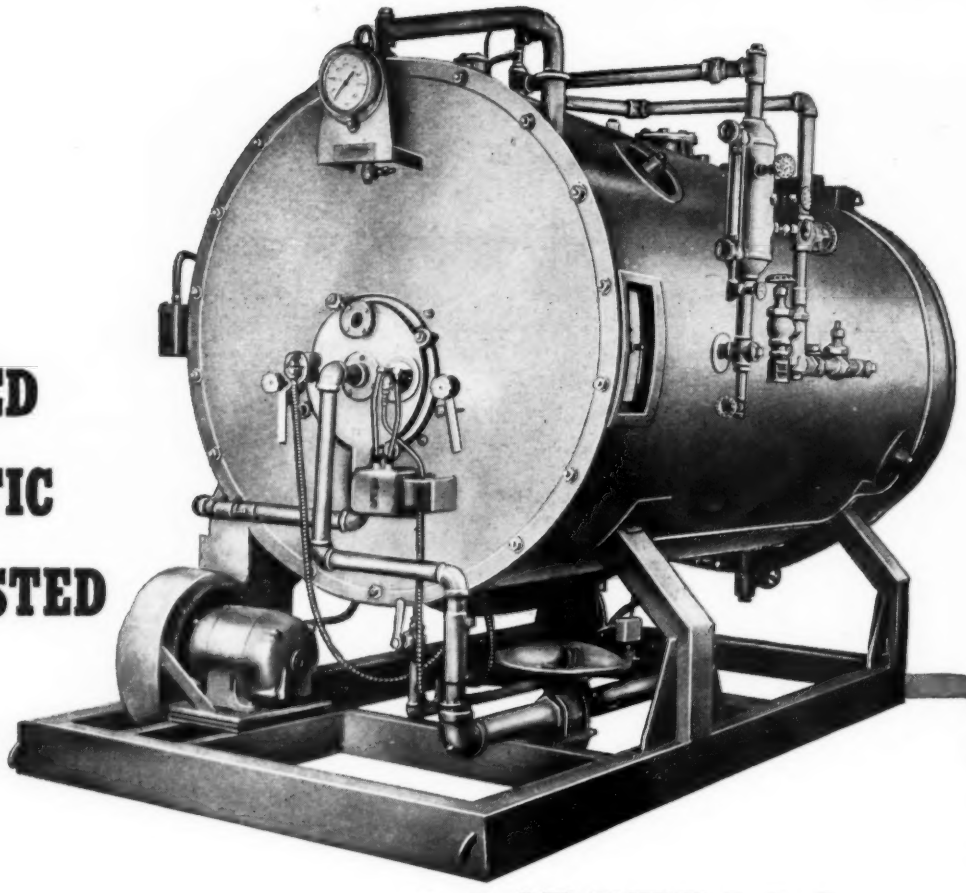
Many problems involved in the piping of oil, chemicals, food products and other viscous materials can be solved by a slight variation of this system. In such cases, where greater heat radiation from the steam line is desired, the pipes are insulated from the exterior but not from each other . . . as shown in the cross section drawing at the left.



Write for Specification Data Book giving complete information on overhead or underground pipe distribution systems.

RIC-WIL
INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY • CLEVELAND, OHIO
CABLE ADDRESS: RICWIL, BENTLEY'S CODE

GAS FIRED
AUTOMATIC
TIME TESTED



AMESTEAM GENERATOR

If you're in a locality where gas – natural, manufactured or mixed – is available at all times, here's the Unit that gives you automatic operation with that fuel.

AMESTEAM Generators have been in operation with gas as fuel for many years – have been time-tested – and are giving complete satisfaction.

In addition to our straight gas fired Units, we offer the AMESTEAM Generator equipped to burn either gas or oil selectively. If your local conditions only permit the use of gas for certain periods of the year, or if oil firing would be most advantageous for certain periods, the combination oil-gas Unit is the answer. The change-over from one fuel to the other is accomplished manually in a matter of a few minutes; when the change-over is made the operation becomes fully automatic.

Combine these advantages with low installation costs, low operating costs, high efficiency and minimum manpower requirements and you have everything you need in a boiler – the AMESTEAM Generator.

WE CAN ALSO FURNISH STANDARD UNITS FOR FIRING WITH ANY OF THE COMMERCIAL GRADES OF OIL.

Write today for your copy of our latest bulletin.

A complete Return to the Boiler System including Feed Water Pump and Condensate Tank with their accessories, is part of the standard equipment with every AMESTEAM GENERATOR.

AMES IRON WORKS
BOX B8 • OSWEGO, NEW YORK

STYLE NO.
920

R/M FLEXIBLE METALLIC PACKING

R/M's flexible metallic packing is a new and valuable addition to the R/M line, recommended for use on steam and air rods, centrifugal pump shafts, valve stems and other applications where the temperature does not exceed 450° F., and surface speed is less than 600′ per minute.

Like a fabric packing, this packing is sensitive to gland adjustment, but it has the added advantage of non-frictional wearing surface. It is constructed of non-frictional metallic foil and asbestos yarns, combined with temperature-resistant lubricants and flake graphite. The outer layer is an open-mesh, braided cotton jacket.

This packing is typical of the engineering that goes into R/M products. For special jobs where you need packing by prescription, or for the routine work where you demand the utmost in dependability, see the authorized R/M distributor near you.

RAYBESTOS R M MANHATTAN

R M

RAYBESTOS-MANHATTAN, INC.

ASBESTOS TEXTILE & PACKING DIVISION

Manheim, Pa. • Bridgeport, Conn. • North Charleston, S. C. • Passaic, N. J.

IT'S "PACKED WITH SATISFACTION" WHEN YOU USE R/M

"OTIS MAINTENANCE?

—JUST LIKE GETTING NEW ELEVATORS EVERY YEAR!"

"My Otis elevators were installed in 1932 when my building was new.

"I had Otis maintain them from the very first. I was too busy to worry about them myself — and besides I knew that no one else would care for them like the company that built them.

"All through the years Otis has kept my elevators in tip-top condition . . . and the elevator service in my building has been the best in town.

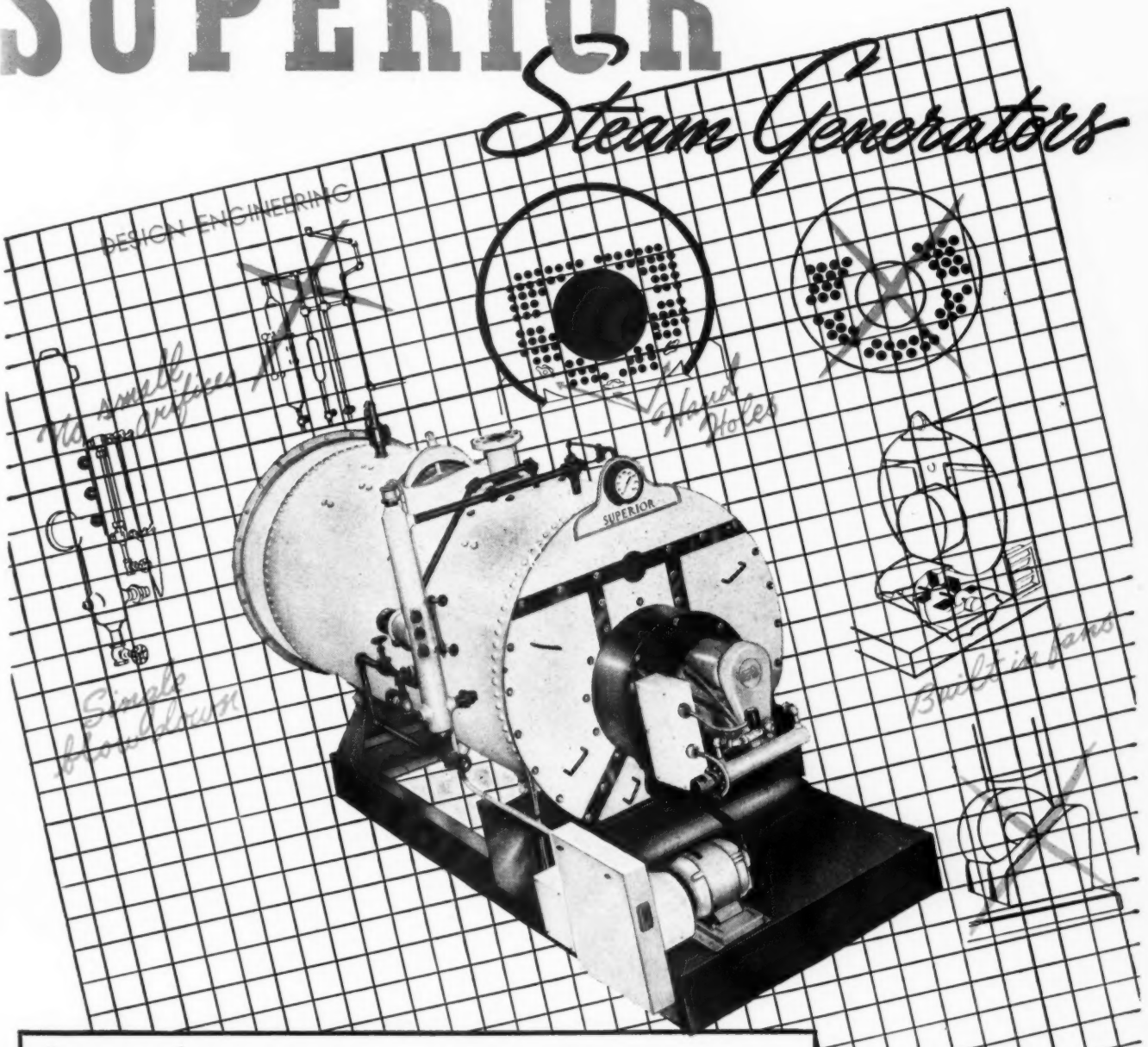
"Today, my elevators are running as well as they did in '32 — and that's why I say that Otis Maintenance is just like getting new elevators every year!"

Otis Maintenance keeps your elevators running like new. It is available at a flat, monthly rate from your nearby Otis office.

Otis ELEVATOR COMPANY

OFFICES IN ALL PRINCIPAL CITIES

SUPERIOR *Steam Generators*



Designed as a Package . . . . Right from the engineer's sketches, Superior Steam Generators were designed to make a more functional and efficient package. The large water column, enclosing pump feed and dual low-water cut-offs, with a single blow-down eliminates small sediment-collecting pockets. The in-line tube layout with adequate handholes permits cleaning of the water side. Induced draft is created by special fans designed to blend into the harmony of over-all design, contributing to the compact, uncluttered smoothness of the finished product. Fully automatic with all grades of oil. Available in sizes from 20 to 500 b.h.p. for pressures from 15 to 200 p.s.i. Write for Catalog 101.

Superior Combustion Industries, inc.

Emmaus, Pa.

Who cares what a waffle costs?

When Mary plugs in the waffle iron, she isn't thinking about the cost of baking the waffle.

And Hubby John's mind is on the maple syrup—not on his electric bill. If you asked them what it costs for their breakfast treat in terms of the electric bill, they'd answer, "Not much."

And right they are! Unending efforts toward greater efficiency in power production have given John and Mary—and millions like them—abundant power at a price which they agree is reasonable.

In effect, the power producers have been most interested in the cost of waffles. Farsighted investments in new equipment—new methods—to raise plant efficiency are traditional with the industry.

To this end, American Blower has worked closely with producers of power. Three American Blower products—mechanical draft fans, fly ash precipitators and Gyrol Fluid Drives for draft fans and boiler feed pumps—assist in increasing overall plant efficiency.

If your plans call for a new plant or modernization, you'll want the finest equipment available. Why not investigate these American Blower products now? A representative trained and experienced in the power field is ready to help with your specific problem.

Call the nearest American Blower Branch office for details.

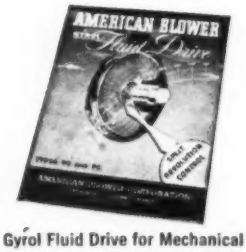
AMERICAN BLOWER CORPORATION, DETROIT 32, MICH.
In Canada: CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.

AMERICAN BLOWER

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

4 books on products to improve overall power plant efficiency

Gyrol Fluid Drive for Boiler Feed Pumps—Bulletin No. 8019

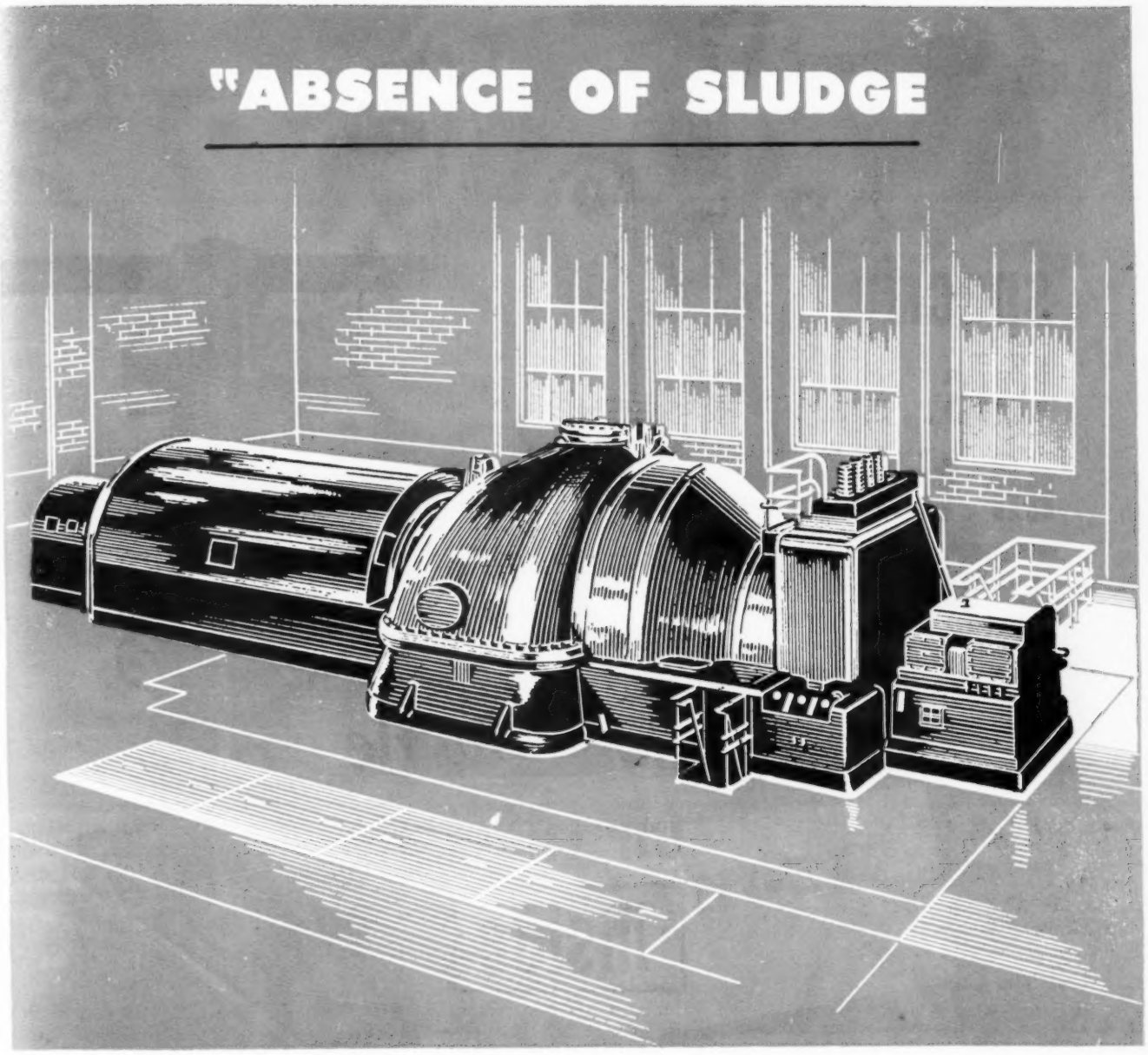


Gyrol Fluid Drive for Mechanical Draft Fans—Bulletin No. 7019

Fly Ash Precipitators (Series 361) Bulletin No. 1628

American HS Forced Draft Fans Bulletin No. A-703

"ABSENCE OF SLUDGE



. . . with Tycol turbine oil"

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C.
Chicago • Detroit
Pittsburgh • Philadelphia
Tulsa • Cleveland
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TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE • NEW YORK 4, N. Y.

"Fifteen years without oil change . . .

Oiling system clean at all times . . .

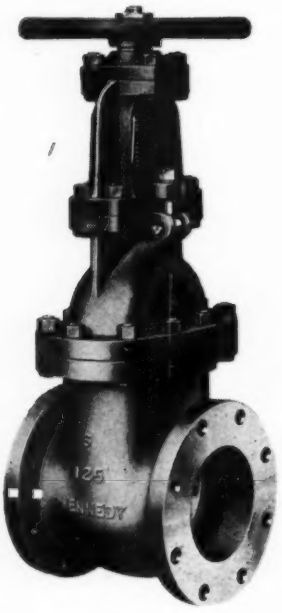
Low maintenance costs . . .

Tycol turbine oils used exclusively . . ."

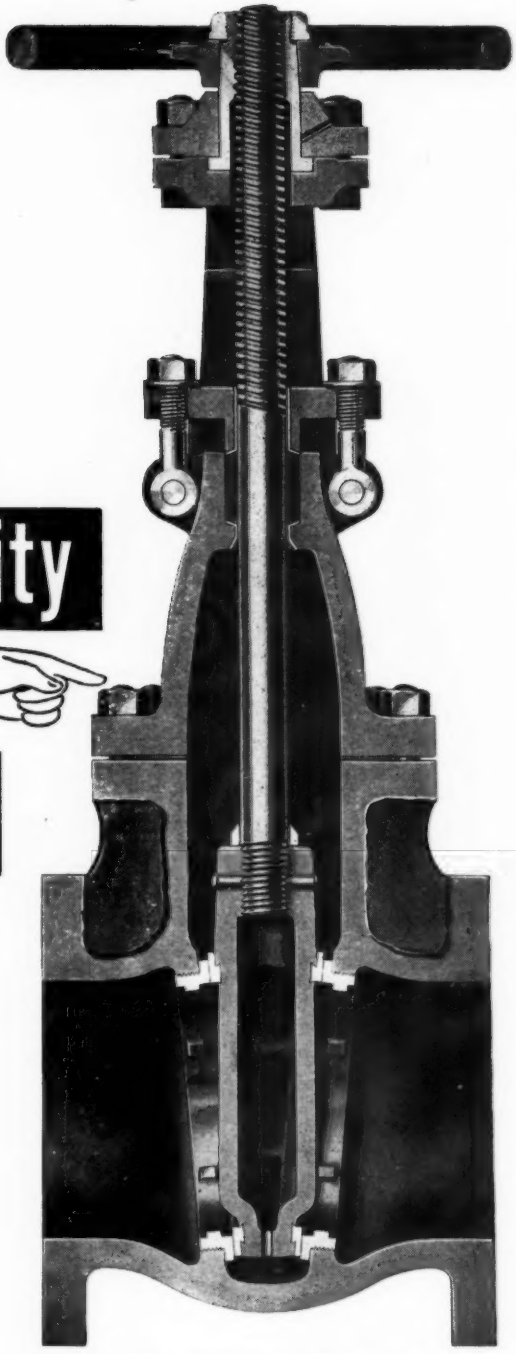
—that's how one general superintendent describes the superior qualities of Tycol Turbine Oils. "These qualities are extremely important to us," he added, "and have, of course, resulted in low maintenance costs".

For full details concerning Tycol Turbine Oils, call, write, or wire your nearest Tide Water Associated Office.

LUBRICATION—"ENGINEERED TO FIT THE JOB"



specify this..... on the **outside** to get **durability** on the **inside**



Kennedy Valves are durable. Look at this iron-body gate valve . . . note the stout construction of the disc . . . the exceptionally thick and wide disc and seat rings . . . the heavily proportioned stem threads.

You get these and many other features when you specify Kennedy Valves. Want full details? . . . write for a copy of Kennedy's 240-page Catalog. It contains complete information on the Kennedy bronze and iron-body gate, globe, angle and check valves, pipe fittings, flanges, and other valves and accessories.

BUY FROM YOUR LOCAL DISTRIBUTOR

KV-148

The Kennedy Iron-body Wedge Gate Valve is made for a range of pressures with non-rising stem or outside-screw-and-yoke. Illustration shows standard type, outside-screw-and-yoke.

KENNEDY valves-pipe fittings-fire hydrants

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK *Offices and Warehouses in Principal Cities*

Makes Condor Homo-Flex HOSE the "Heavy-Work" Champion

Rubber Engineers have discovered the most damaging punishment to hose is the constant flexing of the hose wall under the thousands of rapid pulsations of high pressure pumping. Adding sheer bulk to the hose construction is not the answer.

Manhattan engineers solved the problem with an entirely new hose construction. Working on much the same theory as a clever boxer who "rides with the punches" to avoid a beating, Manhattan engineers developed a hose wall that would expand and contract rapidly – "riding" the rapid surges of pressure. Though lighter and more flexible, Homo-Flex is actually stronger – longer lived – because Flexlastics tube, cord Strength Member and wear-resisting Flexlastics cover are made practically inseparable through Turnate Vulcanization.

Whatever industry you are in, check the 10 Advantages of Condor Homo-Flex Hose for air, water, high pressure spray, etc. A copy of Bulletin 6879-A is yours for the asking.

("FLEXLASTICS" is exclusive with MANHATTAN)

RAYBESTOS R M MANHATTAN

RAYBESTOS-MANHATTAN INC.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION **PASSAIC, NEW JERSEY**

This is the sedimentation tank for the Cochrane Cold Process Softener. Its dimensions (24 ft. dia. x 27 ft. high) are based on a 2 hr. retention time for softening plus storage space for 20,000 gal. backwash water for filters and zeolite softeners.

THE Cochrane Water Conditioning Equipment installed at a prominent steel plant in Minnesota, is a fine example of Cochrane's ability to solve any problem having to do with the conditioning of boiler feed water.

1. A Cochrane Clarifier (Rapid Reactor) of 32,500 GPH capacity, the sedimentation tank of which appears above. The chemical feeds shown below (center) comprise coagulant and alkali tanks with proportioners and feed pumps. The proportioners are electrically controlled by an indicating, recording and integrating electric flow meter.

2. The Cochrane Vertical Pressure Filters are also shown below (right) and in the foreground an alkali tank with a stirrer for the addition of alkali to control the pH value after filtering.

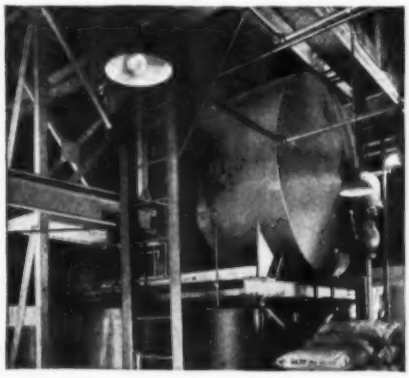
3. A 3-unit Cochrane Carbite (Carbonaceous Zeolite) Softener. Maximum total rate of 543 GPM.

4. A Cochrane (Tray type) Deaerator of 320,000 lbs/hr consisting of 70,000 to 270,000 lbs. of condensate at 100°F. from surface condensers. The make-up comes from the Cochrane Zeolite Softener at 50°F. Water of zero oxygen is delivered to two boilers. This installation illustrates the versatility of Cochrane equipment and attests to the wealth of experience that makes possible this versatility.

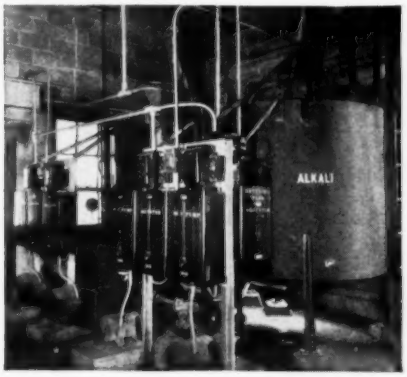
Write for recommendation on your own water problems.

COCHRANE CORPORATION
3106 N. Seventeenth St.
Philadelphia 32, Pa.

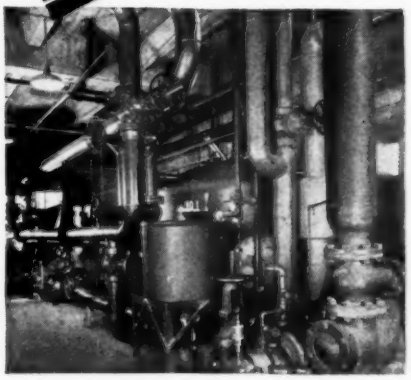
COCHRANE
SINCE 1863



Cochrane Cylindrical Rolled Plate Deaerator with Storage Tank.



Cochrane Chemical Feed showing coagulant and alkali tanks with proportioners and feed pumps.

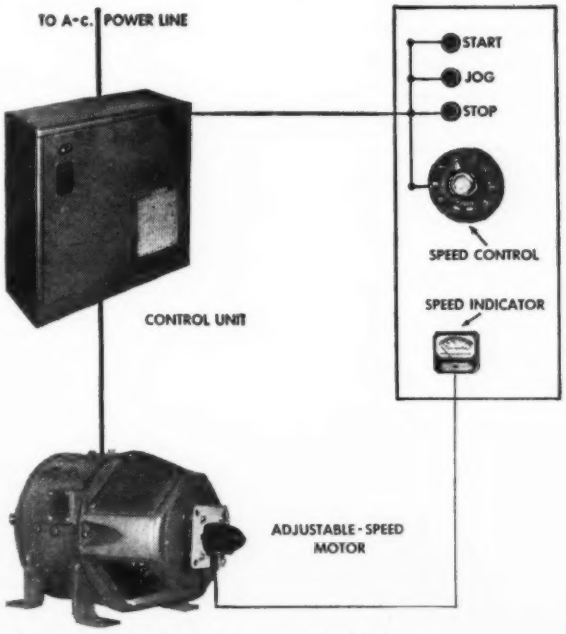


Cochrane Vertical Pressure Filters with an Alkali Tank in the foreground with a stirrer for the addition of alkali to control the pH value after filtering.

RELIANCE V★S DRIVE

Greater PRODUCTION with ADJUSTABLE-SPEEDS

...from A-c. Circuits



Conveniently-packaged, space-saving V★S Drives are available from 1 to 200 hp.

Actually, Reliance V★S Drive is an *electric transmission.* At the touch of a button your machine can be started or stopped. Turn the knob of a rheostat and it can be accelerated or decelerated smoothly—over an infinite range of stepless speed changes. And with this *All-electric, Adjustable-speed Drive operating from A-c. Circuits,* control can be either automatic or manual . . . at the machine or from remote stations. The net result of V★S control is greater efficiency, faster production, lower costs—as already proved in every industry. That's why it will pay you to write today for Bulletin 311.

RELIANCE ELECTRIC & ENGINEERING CO.
1068 Ivanhoe Road • Cleveland 10, Ohio

Appleton, Wis. • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Dallas Denver • Detroit • Gary • Grand Rapids • Greenville, S. C. • Houston • Kansas City Knoxville • Los Angeles • Milwaukee • Minneapolis • New Orleans • New York Philadelphia • Pittsburgh • Portland, Ore. • Roanoke, Va. • Rockford • St. Louis San Francisco • Seattle • Syracuse • Tampa • Tulsa • Washington, D. C. Sao Paulo, Brazil

RELIANCE A-C D-C MOTORS

"Motor-Drive is More Than Power"

How will you have your welding?

There is no one piece of all-purpose equipment or any one method that will produce peak-quality welding on every type of job.

A continuous submerged arc track-welder, such as the one illustrated here, does a perfect job on longitudinal inside pipe seams. Conversely, the sections of large diameter vessels should be welded together on a rotating unit, where the seam on the outer circumference moves at a consistent speed past a fixed electrode.

Kellogg shops are equipped with these and every other standard welding device, plus some of our own invention. But more important to a "top" job are the unusually high qualifications of Kellogg welding operators and the perfection that results from a rigid check-up and inspection system.

It's common at the Kellogg plant to make as many as 1,000 X-rays of welds a day—which means that every welder performs with the expectation that his work may go before the all-seeing eye of the X-ray machine. It's extra care like this that puts that extra margin of quality in Kellogg work—a big reason why so many of the world's top industries head for Kellogg when there's a particularly tough job to be done.

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

KELLOGG

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
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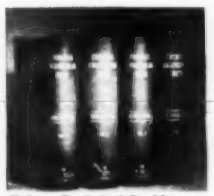
VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING PROCESS PIPING • FORGED AND WELDED FITTINGS...IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.



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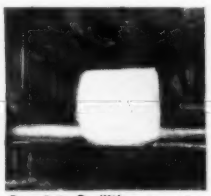

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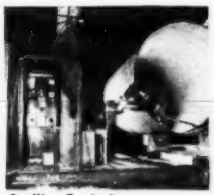

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A SUBSIDIARY OF STONE & WEBSTER, INC.

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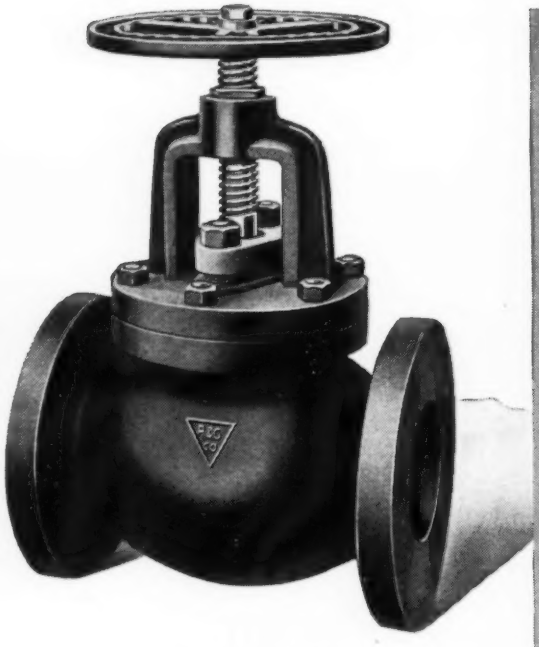

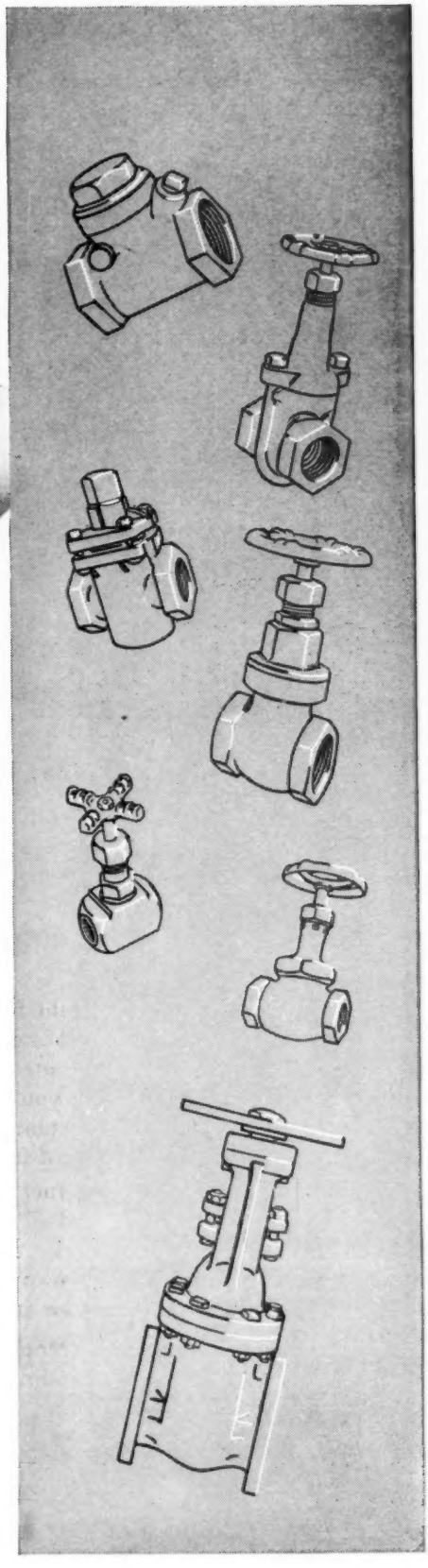

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READING, PA.—When you select valves—or any other operating equipment—you want the most you can get for every dollar you invest. That means you have to balance (1) first cost against (2) length of service and (3) maintenance cost.

We have known this for many years—ever since we started building valves, in fact. When, from time to time, we find ways to improve our products, it is with one idea in mind. And that is to . . .

. . . give you more for the money you invest—*more in terms of over-all valve economy.*

Consider your Reading-Pratt & Cady distributor as a single responsible source for bronze, iron and steel gate, globe, angle and check valves—iron cocks and Lubrotite gate valves—Bar Stock valves of bronze, carbon steel and alloy steels—cast steel fittings.

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READING-PRATT & CADY DIVISION
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You may convert the fuel supply of a Cyclotherm to either oil or gas by a simple change—a matter of minutes to make. This quick conversion allows you to take immediate advantage of any fluctuation, seasonal or otherwise, in the price of fuel.

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The automatic modulating steam pressure control system of a Cyclotherm Steam Generator provides the proper quantitive fuel-air relationship for all firing rates with oil (or gas) and air pressure constant. Firing rates are modulated from 30% to 100% of rated capacity in response to steam demand. Throughout the whole range of modulation the Cyclotherm unit is guaranteed 80% efficient.

Cyclotherm Steam Generators are manufactured in sizes ranging from 10 to 300 HP, and with operating pressures from 15 to 200 psi. If any one of these sizes does not meet your steam requirements a battery of two or more units will.

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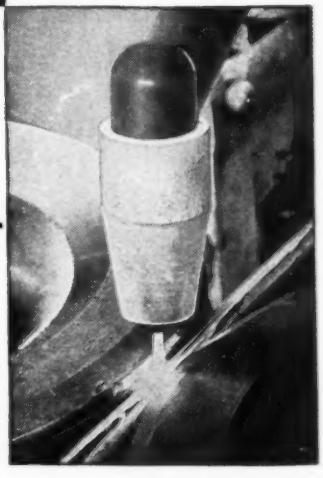
Linde's HELIARC process is a new and different method of welding with the electric arc, in which the welding action is shielded by an inert gas—usually argon.

Joints welded with the HELIARC process have exceptionally high quality. They are clean because HELIARC welding eliminates flux. Joints are so smooth, even, and neat that usually no finishing treatment of any kind is required.

Butt, lap, tee, corner, and angle joints are easily made on rolled, cast, extruded, or forged parts of stainless steel and practically all non-ferrous alloys of any commercially used thickness.

HELIARC welding can be done manually or with machines and is equally practical for mass production or job lots.



Linde service engineers are always available to help with problems of treating, cutting, joining, and forming metals.

Call or write any Linde office for information.

The word "Heliarc" is a trade-mark of The Linde Air Products Company.

THE LINDE AIR PRODUCTS COMPANY

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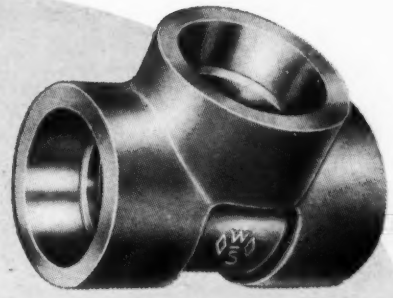
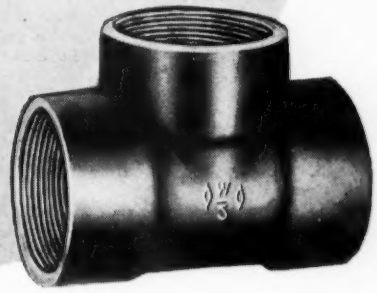
NOW A COMPLETE LINE IN STAINLESS STEEL



W-S FORGED STAINLESS STEEL PIPE FITTINGS

(Screw-End and Socket-Welding Types)



Now you can save time and money by ordering your stainless steel pipe fittings from Watson-Stillman, because the W-S line is complete in both screw-end and socket-welding types. The following AISI types are offered:

TYPE 304. Highly resistant to corrosion and high temperature oxidation. When fully annealed has excellent impact properties at extremely low temperature.

TYPE 347. Identical to Type 304 with the added advantage of maintaining its fine corrosion resistance properties without heat treatment after fusion welding.

TYPE 316. Similar to Type 347 except that the addition of Moly increases its corrosion resistance properties in a wide variety of services.

3145

Such stainless steel fittings are money-savers because they do not corrode or erode, thus preventing product contamination and assuring long, dependable service.

The complete line of Watson-Stillman Forged Steel Pipe Fittings includes Screw-end and Socket Welding types in Carbon Steel, Carbon-Molybdenum and Chromium-Molybdenum, as well as Stainless Steels. In selecting equipment for particular applications, ask for the advice of a Watson-Stillman expert.

WATSON-STILLMAN CO. • Roselle, New Jersey

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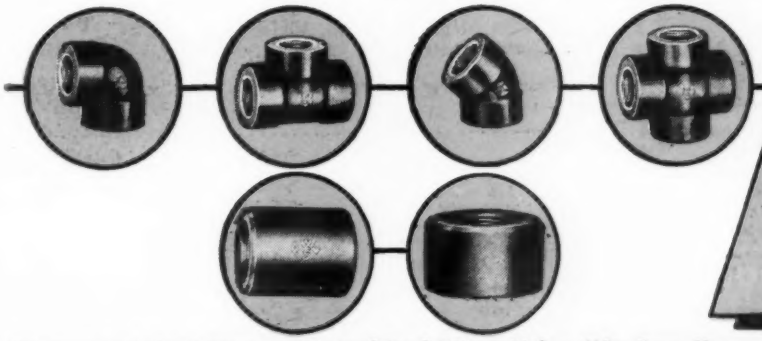

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ESTABLISHED 1848

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

Replace GASKETS THIS *Better Way*

Standard No. 20 $24.00 a pair
Giant No. 30 $48.00 a pair

These fully-patented **FLANGE-JACKS**, formerly manufactured by T. G. Persson Co., of Bloomfield, N. J., are job-tested and meet the requirements for fast, safe and easy gasket replacement.

Operating with a minimum of effort . . . vital in tight, cramped quarters . . . **FLANGE-JACKS** exert tremendous pressure smoothly and evenly. There is no shock along the pipe line, bolt holes are maintained in perfect alignment, and flange faces cannot be damaged. **FLANGE-JACKS** eliminate long, costly shut-downs. See your distributor for trade discounts.

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Flange-Jacks

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★INDUSTRIAL VALVES
★LOW PRESSURE GAS VALVES
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Controls for air, water, steam, natural, manufactured and liquefied petroleum gases, light and heavy oils, etc., refrigerants such as freon, methyl chloride, sulphur dioxide and ammonia . . . normally closed or open types. High A.C. or D.C., normally closed or open types. High and low pressures, and temperatures. PROVED AND IMPROVED PERFORMANCE IS PROOF THAT YOU CAN'T BUY BETTER CONTROLS.

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801 ALLEN AVENUE GLENDALE 1, CALIF.
Manufacturers of Automatic Pressure, Temperature and Flow Controls
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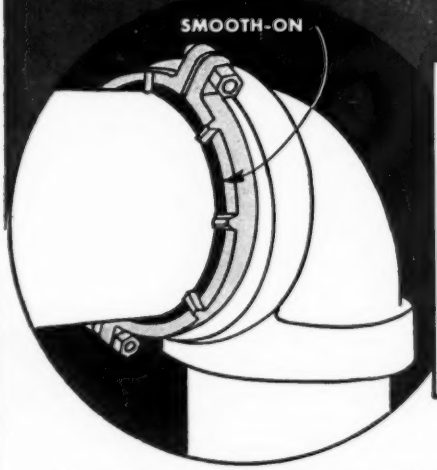
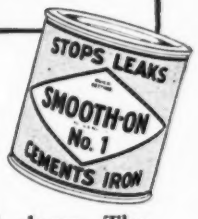
QUICK WAY TO STOP PIPE-THREAD LEAKS





You don't have to take the joint apart. Just bolt a Smooth-On Clamp around the pipe, close to the fitting. Then tamp Smooth-On No. 1 Iron Cement tightly between pipe and clamp. The cement will set quickly, stopping the leak.

Smooth-On No. 1 expands a little as it sets. This makes it stay tightly in place.

Repairs made this way are inconspicuous. When used at flanged joints, Smooth-On Clamps do not interfere with flange bolt heads. Supplied in sizes for ⅜" up to 12" piping.

Ask for Smooth-On Clamps and Smooth-On No. 1 Iron Cement at your supply house. If you do not find them there, write us.

FREE 40-PAGE REPAIR HANDBOOK

Filled with practical, time-saving, money-saving ways to stop leaks, tighten loose parts and fixtures. Clear, tested directions. 170 diagrams. Send coupon for YOUR free copy now.

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Do it with **SMOOTH-ON**
THE IRON CEMENT OF 1000 USES

Stellar power performance by ENTERPRISE

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NEW ORLEANS

Sometime during the coming months the big eye perched on Palomar Mountain will open for its first glimpse into space. This mammoth 200 inch telescope—the largest in the world—depends on three ENTERPRISE Diesel-driven generating units for its complete power requirements. Over 300 miles of wiring inside Palomar's dome carry current to the delicate rotating mechanism, scores of robot controls, intricate lighting, pumping, clock and air-conditioning systems.

Where power failure at any time would stall and impair critical observations, much study of power applications was made by Palomar's great engineers and scientists. The selection of ENTERPRISE Diesels is indeed high testimony of the dependability and reliability of this power for such an exacting assignment.

You too will find in ENTERPRISE Diesels a flexibility of application to meet your special power requirements. We invite your investigation of the wide range of ENTERPRISE Models. Normally-aspirated or turbocharged up to 1800 HP per unit.

DIESEL ENGINES • PROCESS MACHINERY • OIL BURNERS • HEAVY MACHINERY

HAHN PRODUCTS FOR ECONOMY & EFFICIENCY

PIPE-LINE or PNEUMATIC CONVEYORS
FOR ASHES AND FLY-ASH

"Most economical in steam-consumption and maintenance." Design of every part, fitting, etc., based on our experience of 25 years with the successful manufacture and operation of conveyors of this type and on our full appreciation of their special requirements.

We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

CAST IRON SECTIONAL ASH TANKS, COAL BUNKERS, BINS, HOPPERS and SILOS

Durability combined with our exclusive discharge- and self-clearing designs, preventing arching, packing and spontaneous combustion in case of coal bunkers and also obviating the necessity of hazardous trimming.

MECHANICAL SOOT BLOWERS FOR FIRE-TUBE BOILERS of ALL TYPES

Fixed nozzle centered to each tube. No cutting of tube-sheet. No moving parts in hot boiler. All tubes in boiler blown with four successive puffs of steam or air in about one minute. Perfect soot-removal from each tube END TO END.

Complete Data on Request

HAHN EQUIPMENT CORPORATION
(formerly Hahn Engineering Company)
30 Church St. New York 7, N. Y.

Hi-Pressure Gage Glasses

Round, Tubular and Flat Type

Fig. 12

RUBBER GAGE GLASS GASKETS
Series 750 . . . All Sizes

Fig. 21 Fig. 22

Other Ernst Specialties
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GAGE GLASS ILLUMINATORS
NEW PLASTIC GUARDS
SIGHT FLOW INDICATORS
SPLIT-GLAND WATER GAGE
STEEL GAGE VALVES
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ALL IRON GAGES
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MICA SHIELDS AND GASKETS
AND OTHER HELPFUL TIPS ON BOILER ROOM SAFETY

Inclined for Better Visibility
Standard Type—Offset Adjustable Inclined Gage Fittings

Fig. 47

Fig. 13

Leakless Super Try Cocks, Bronze and Forged Steel Construction

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Ernst WATER COLUMN & GAGE CO.
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Positive Vapor Control with BS & B VENT VALVES

B S & B Vent Valves offer positive protection against excessive vapor loss when storing petroleum products. Overpressure lifts cover, allowing vapors to escape. Excessive vacuum lifts valve gasket, permitting in-breathing until normal pressure is restored.

Specifications to fit your venting requirements:
Sizes 2" to 24"; Standard opening pressures, 3 to 1½ oz.; Maximum opening pressures, 16 to 4 oz.; Standard opening vacuum, ½ oz. Bodies, Covers, Gaskets, in wide variety of metals and materials.
Call your nearest B S & B Sales Engineer today! Or write to Special Products Division, Black, Sivalls & Bryson, Inc., Power and Light Building, Kansas City 6, Missouri.

SPECIFICATIONS

Model Number	Size, Inches	Standard Opening Pressure, Ounces	Maximum Opening Pressure, Ounces	Standard Opening Vacuum, Ounces
2VVH	2	3	16	½
3VVH	3	3	16	½
4VVH	4	2	16	½
6VVH	6	2	16	½
8VVH	8	2	16	½
10VVH	10	2	16	½
12VVH	12	2	10	½
16VVH	16	2	8	½
20VVH	20	2	6	½
24VVH	24	1½	4	½

FOREIGN INQUIRIES INVITED
Cable Address: BLACK, KANSAS CITY, U.S.A.

BLACK, SIVALLS & BRYSON, INC.
EFFICIENCY RELIABILITY

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Importance of Field Tests in Selecting Condenser Tubing

Operators are anxious to make the shrinking dollar go further by reducing maintenance and replacement expense, and by increasing the service life of all their equipment. Since surface condensers play such a vital part in the operation of every power plant, the importance of using the most suitable condenser tubing is generally recognized.

Selection of a condenser tube alloy which will give the most satisfactory results at the lowest cost per thousand service-hours is a complicated business which depends upon a great many factors. In order to help customers, Bridgeport maintains a consistent program of corrosion research. Through cooperation with power plant engineers in various parts of the country, we have found that the behavior of condenser tubing varies considerably.

Service Tests Valuable

Since the nature of cooling water and operating procedures are subject to variation, service and field tests are frequently carried out to aid in the selection of the most satisfactory tubing alloy. In order to minimize interruption in service and keep tests on a comparatively inexpensive basis, special racks are made up of sample strips of the alloys to be tested. Such a test rack, containing from 6 to 30 specimens, generally is suspended in the intake tunnel, as close as possible to the water box of the condenser, and submerged 12″ to 15″ below the low water level.

After the necessary time has elapsed (usually 1 to 2 years), racks are removed, carefully packed in exactly the condition in which they are found, and sent to Bridgeport.

Laboratory Examination of Samples

Test specimens are first examined for biofouling. Measurements are then made to determine any dimensional changes which have occurred.

The character of the corrosion is determined—thinning, pitting, impingement, etc. Samples are tested for loss in tensile strength.

All corrosion rate values are converted to mils per year, so that the extent of corrosion may be clearly stated in easily understandable form (see table).

Many Values Must Be Considered

Since inlet end corrosion of condenser tubing is the cause of early failure of some materials, it is necessary to place as much emphasis on the depth of impingement corrosion as on the extent of thinning based on weight loss. Ideally, the alloy selected to stand up under any given condition should have both of these values as close together as possible. This is particularly true with polluted waters. In some instances it may be necessary also to consider the effects of other types of failure, such as grooving, cracking, etc.

A Gulf Coast Experience

Corrosion tests were conducted in a Gulf Coast power plant (see table below) where Admiralty had not lived up to expectations, particularly in one condenser. Examination of the corrosion test data shown for the alloys tested at this plant revealed Duronze IV*, a special arsenical aluminum bronze, to be the best material, both from the standpoint of average corrosion rate as well as the impingement corrosion rate. It is quite obvious that the Duronze IV alloy should be markedly superior to Admiralty. The results are in accord.

The condenser was retubed with Duronze IV, and to date, after approximately 4 years, no failures have occurred. This condenser is now reported to be the best operating unit in the plant.

Alloy	Amount of Thinning Calculated From Weight Loss (Mils per year)	Depth of Impingement Corrosion, Inlet End (Mils per year)
Arsenical Admiralty	11.39	85.0
Duronze IV	5.00	5.8
Cuzinal	9.05	15.3
Cupro Nickel	11.03	89.0

Comparative Corrosion Resistance of Several Copper-Base Alloys to Sea Water at Gulf Coast Power Plant. Water chlorinated for slime control.

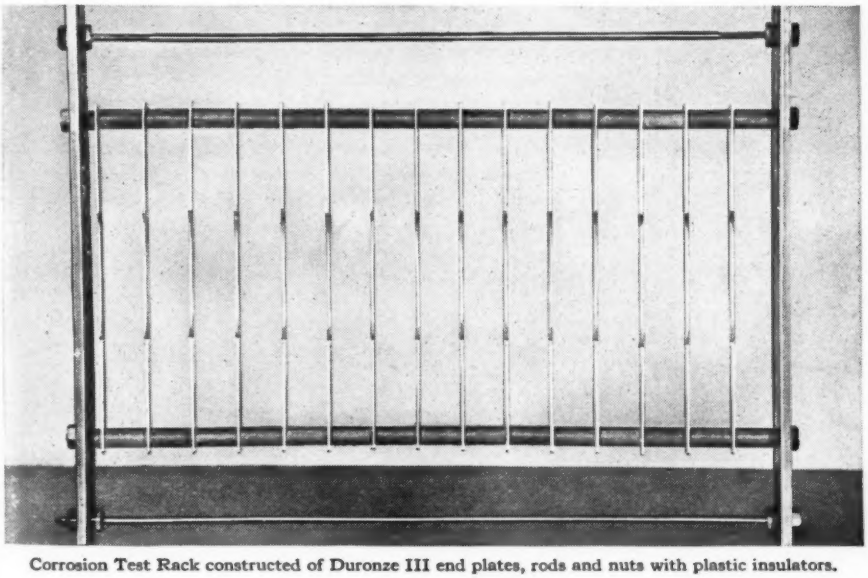
Other Tests with Duronze IV

Examination of the data obtained from several other locations where the water is polluted, either fresh or salt, indicates that Duronze IV makes a good showing. This alloy is not a "cure-all," but has stood up exceptionally well under rapidly flowing fresh or salt water, polluted by sewage and industrial wastes, acids, cinders and other foreign matter. It has been used successfully in plants where salt water is mixed with polluted fresh water, such as tidal estuaries.

Other Corrosion Resistant Alloys

Bridgeport manufactures a wide range of corrosion-resistant condenser tube alloys such as Duronze IV (aluminum bronze), Cupro Nickel, Cuzinal (aluminum brass), Arsenical Admiralty, etc. Bridgeport's corrosion research laboratory and technical service department are designed to help the power plant engineer choose the most suitable condenser tube alloy for his specific conditions. Contact the nearest Bridgeport office for this service and write for 112-page Condenser Tube Manual which contains much practical up-to-date information about corrosion research, condenser tube alloys, methods of installing and suggestions for increasing condenser tube life.

*U. S. Patent No. 2,093,380

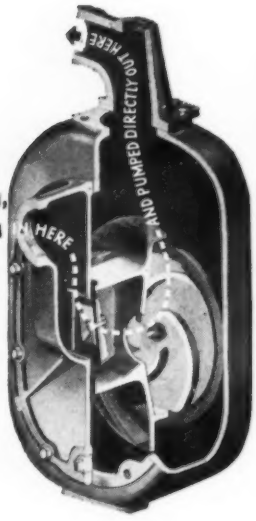


Corrosion Test Rack constructed of Duronze III end plates, rods and nuts with plastic insulators.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal



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A Marlow Self-Priming Centrifugal provides the advantages of centrifugal action—plus inherent ability to prime automatically on high suction lifts. Direct action . . . no wasted motion. 1½ to 10-inch sizes; 25 to 3500 GPM. Data sent promptly. Marlow Pumps, 592 Greenwood Ave., Ridgewood, N. J.

MARLOW PUMPS • *Manufacturers of Quality Pumps Since 1924*

WHITON STEAM TURBINES

★ **Whiton — Single Stage, Solid Wheel Steam Turbines now available**

★ **4–6 weeks shipment—all sizes**

★ **Inquiries invited**

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(Formerly The D. E. Whiton Machine Co.)
NEW LONDON CONNECTICUT

Protects the inaccessible parts of your Steam System from corrosion

CORAVOL in your steam system (1) prevents corrosion in steam and condensate lines, (2) cleans out clogging rust deposits resulting from previous corrosion. Thus, **CORAVOL** *protects lines;* increases effectiveness of heat transfer surfaces; restores original capacity of lines and the operating efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment —it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates thruout your entire steam system and protects *all* zones from corrosive attack.

The use of **CORAVOL** *in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile amines purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.*

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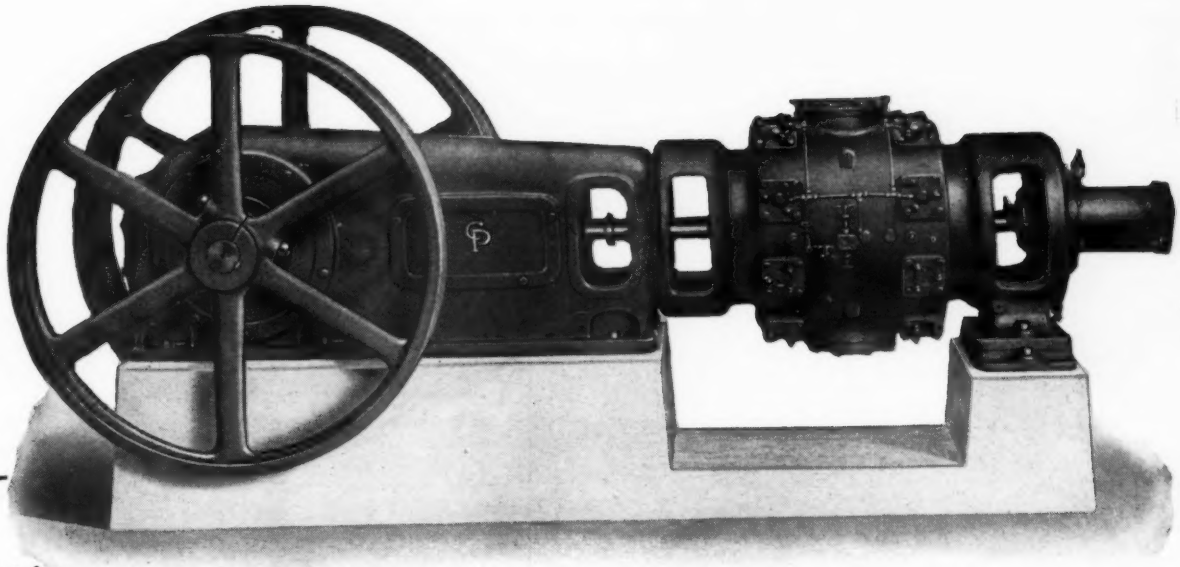

This
COMPRESSOR

...delivers oil-free air

For uses where compressed air or gas must be free from oil, CP Oil-less Cylinder Compressors are ideal, since they require no oil, grease, or other cylinder lubricant.

Piston and rod, completely supported by crossheads, are full floating, removing all weight from cylinder walls and stuffing boxes. Thus long life of carbon piston rings is assured. Normal maintenance only is required — no need for periodic rotation of piston rings.

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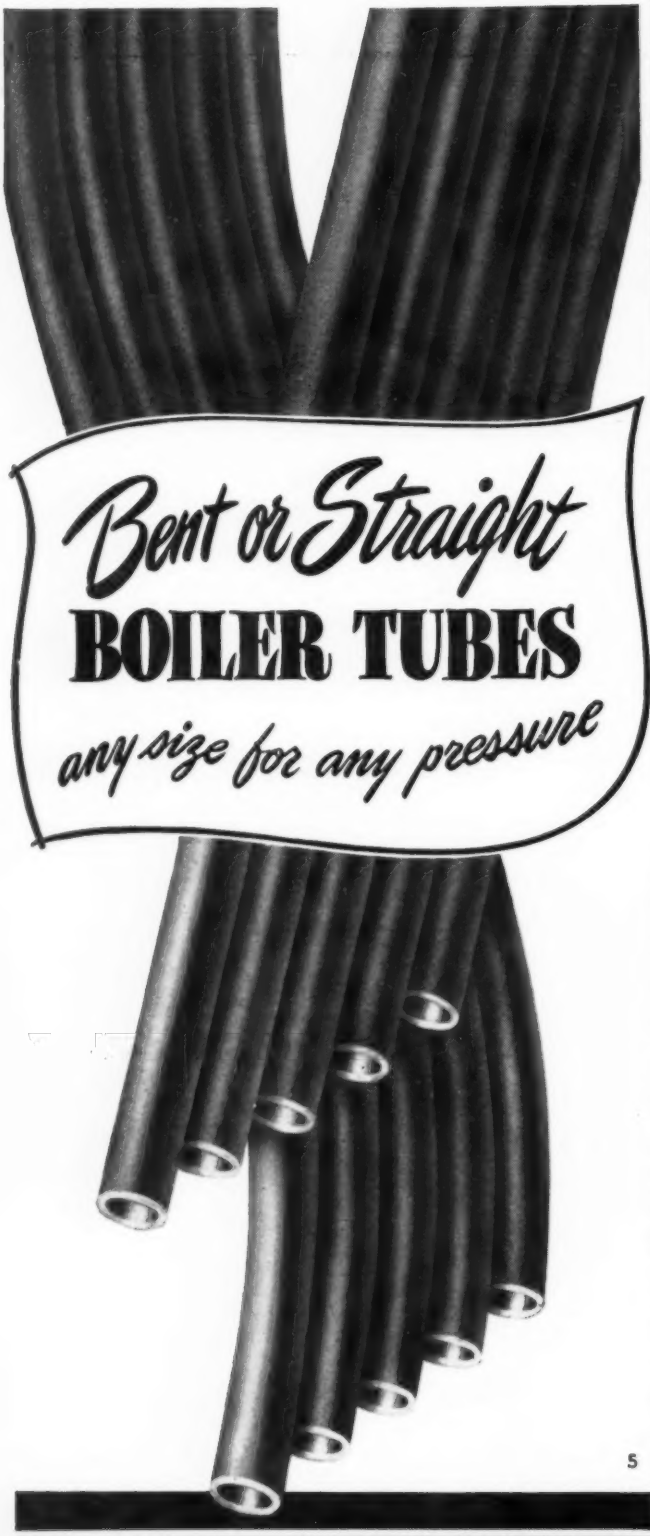

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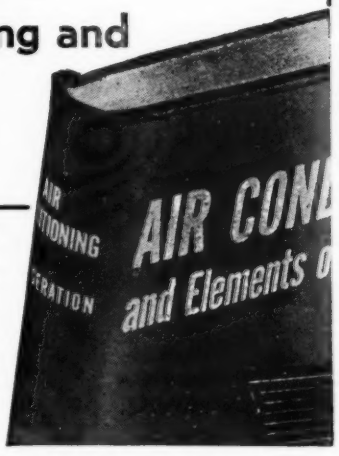

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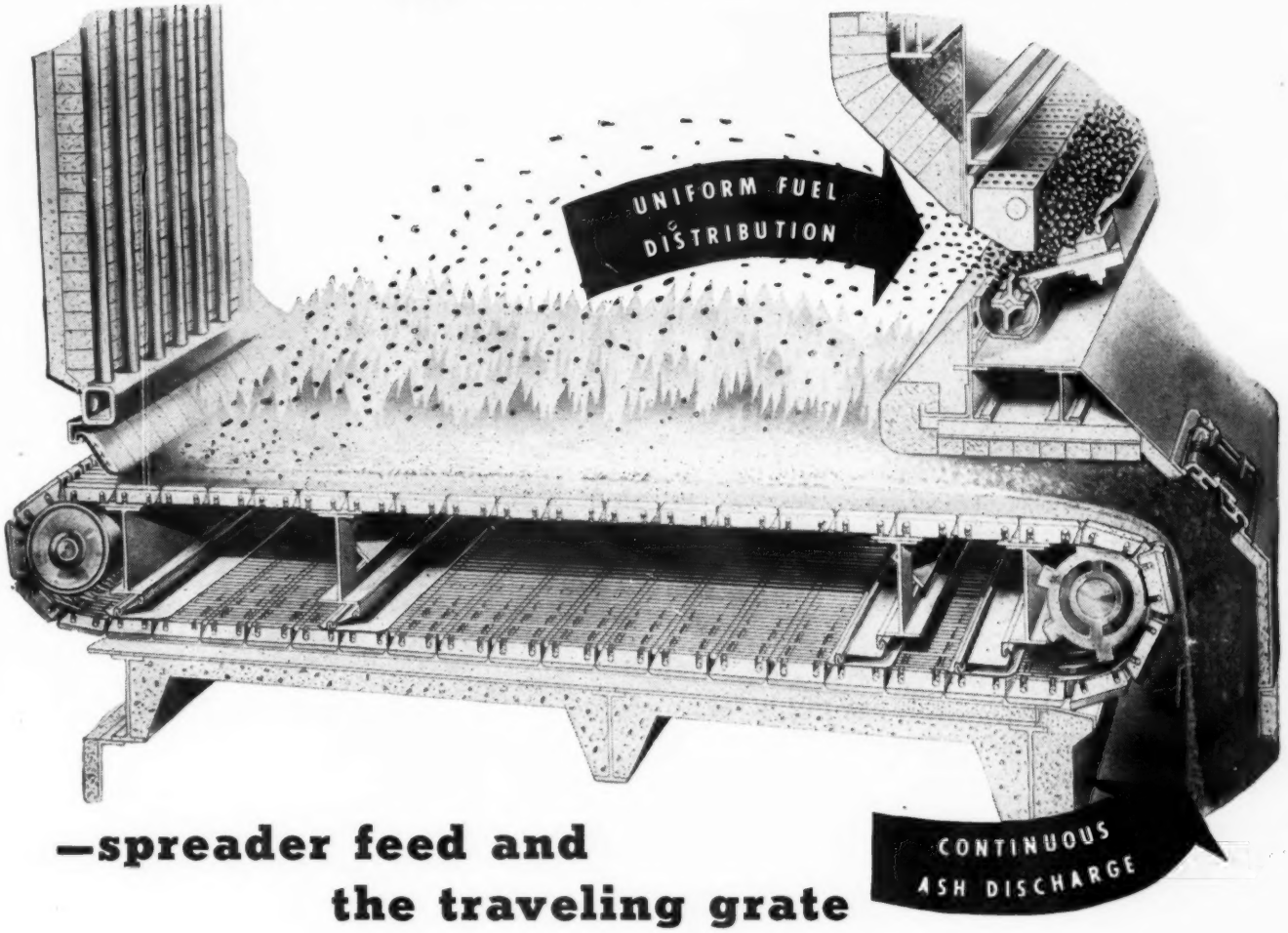

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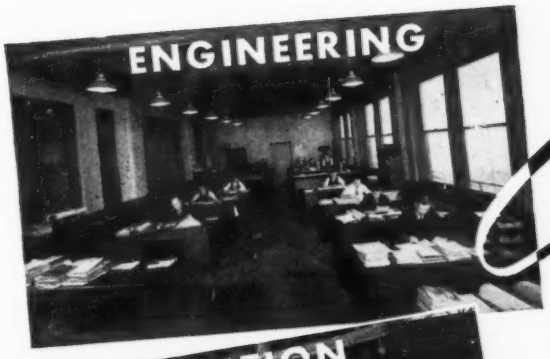

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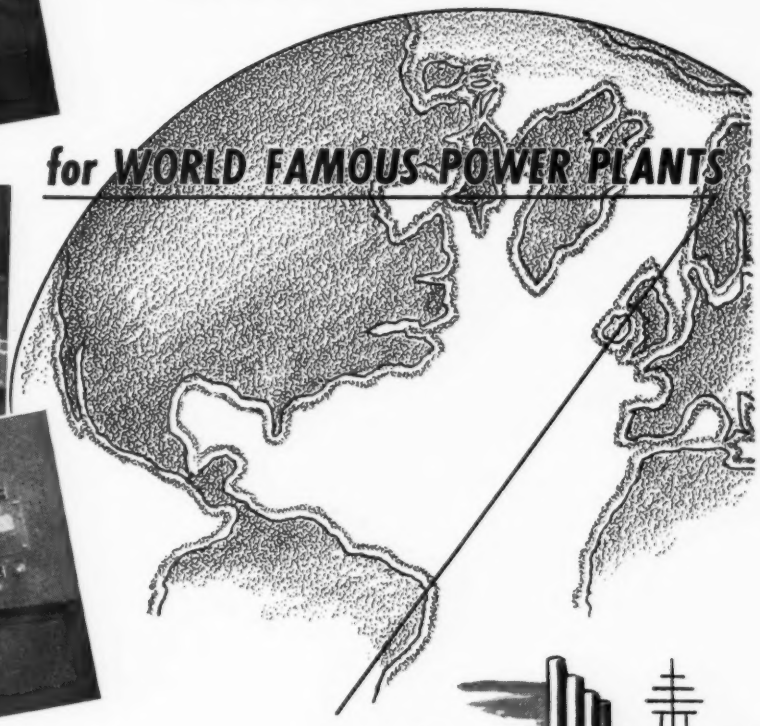

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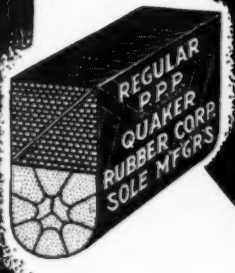

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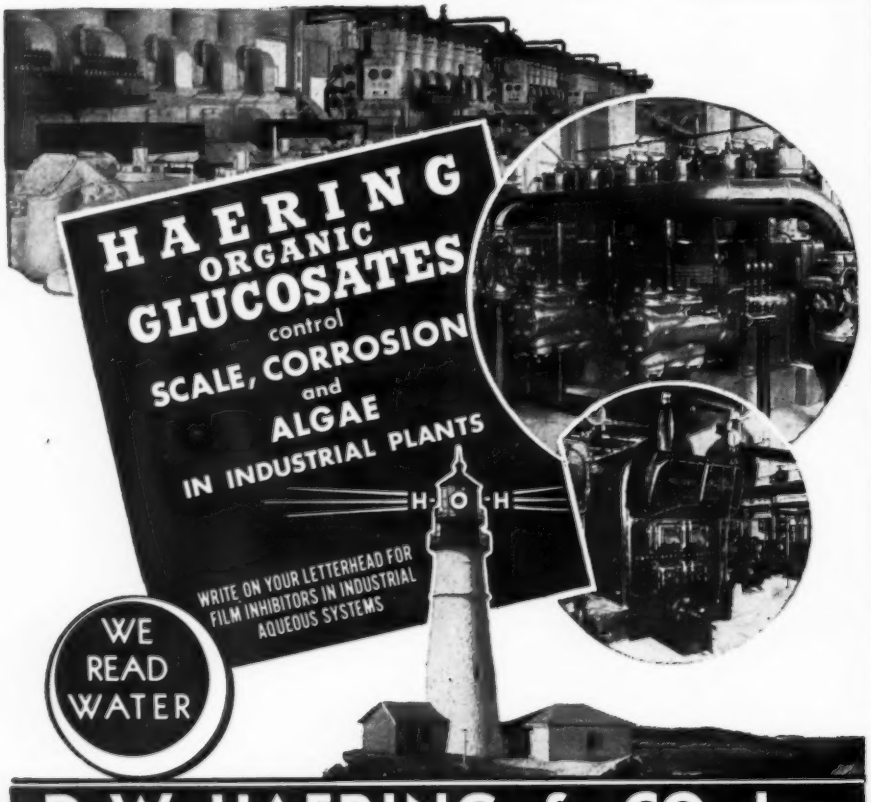

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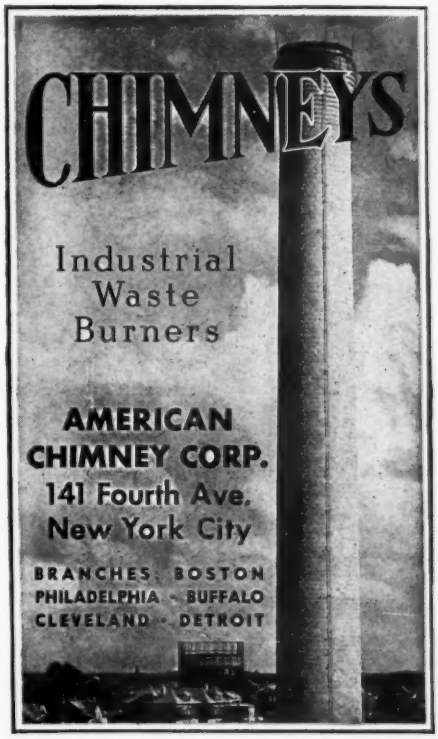

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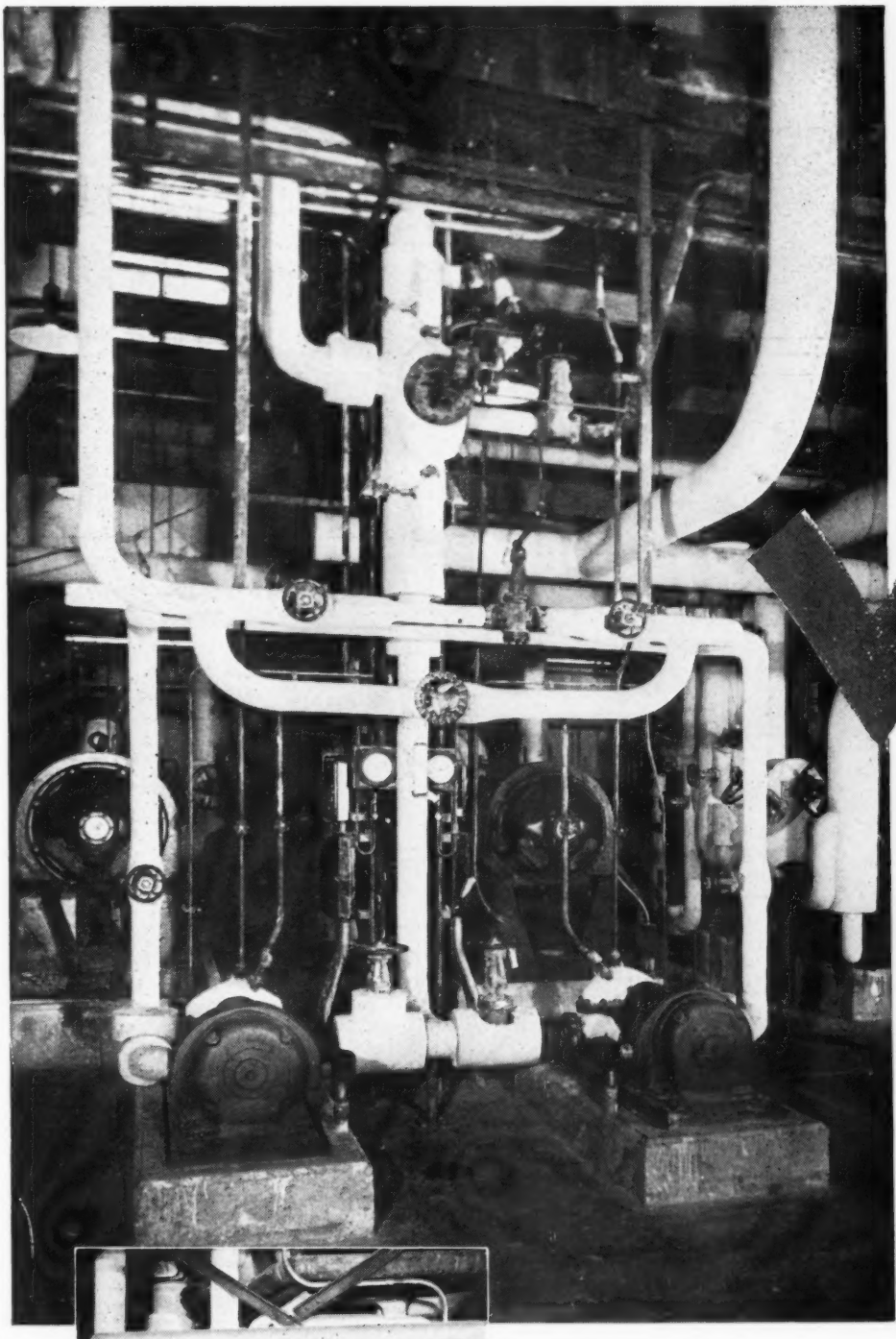

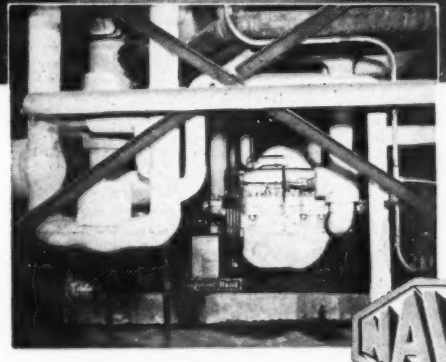

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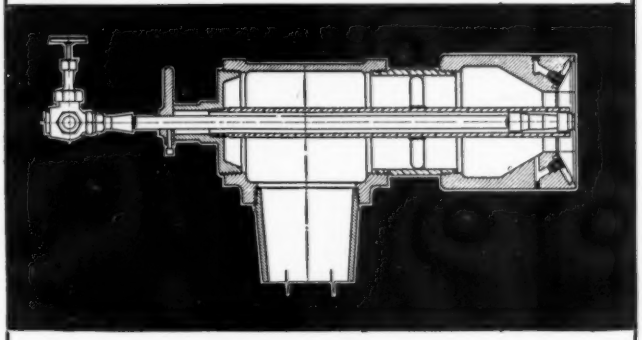

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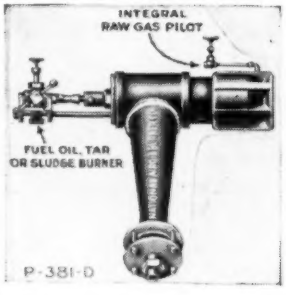

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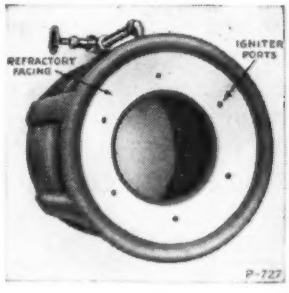

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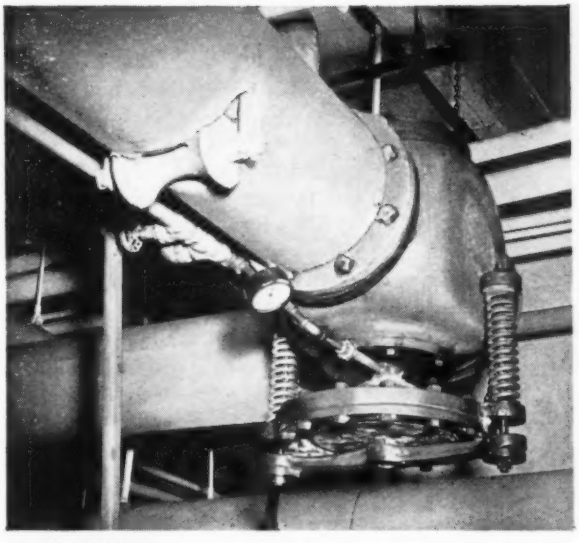


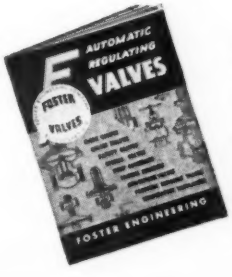
HEATING will be no problem this winter for a large electrical manufacturer who has already installed an 8 inch Foster Type J-2 double seated pressure regulator. It reduces the continuous flow from an intermediate pressure of 65 pounds to heating pressure of 5 pounds. Note that the pilot return line is large—good power plant practice at any time, but especially so when quick response and accurate regulation are required.

Eventually, somebody may figure out a practical way to store up excess summer heat for use in winter.

Until then, it looks as though we'd have to rely on the heating systems we have now, which means that they have to be dusted off and put in shape for another season or two. The logical time to check and overhaul the heating system is when it is shut down . . . in the summertime.

It's the time for *you*, because it is easier to *prevent* trouble than to take care of it as an emergency. No "cold" days for the plant with "hot", all-night repair jobs . . . no temporary makeshifts to be replaced later on.

It's the time for *US*, because we can go over your requirements with you, see that you get exactly what you need from the complete Foster line, and get the necessary regulators or parts . . . from stock . . . in time to be installed before that first call for heat.



DON'T MISS these two helps — the Foster Representative and the Foster Catalog. Foster reps are trained and qualified to see that you get the proper regulator—the catalog is extremely useful in planning because it gives specifications on the various Foster valves. A 3c stamp is all it takes to tell us you want one or BOTH.

FOSTER ENGINEERING Company

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . AUTOMATIC STOP AND CHECK VALVES . . . ALTITUDE VALVES . . . DAMPER REGULATORS . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . LIQUID LEVEL CONTROLLERS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN AND TRIPLE DUTY VALVES . . . VACUUM REGULATORS OR BREAKERS . . . SIGHT FLOW BOXES . . . STRAINERS . . . SAFETY VALVES . . . SIRENS

106 MONROE STREET • NEWARK 1, N. J.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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(Not available for equipment advertising)
90 cents per line, minimum 4 lines. To figure advance payment count 6 average words as a line and allow 10 words for a publication box number address.
POSITIONS WANTED (full or part-time Individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line insertion.

INFORMATION:
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
This advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. P.

NEW ADVERTISEMENTS received by August 11th will appear in the September issue, subject to limitation of space available

---

WANTED

POWER ENGINEER

High-caliber man with M.E. and fifteen years' responsible experience, to supervise operations of steam-electric generating station, refrigeration and air conditioning systems.

Must be able to get along well with associates, know costs, and be willing and capable of assuming responsibility.

P-1144, Power
330 West 42nd St., New York 18, N. Y.

WANTED

ENGINEERS

Wanted by Michigan firm of engineers, men qualified for structural and mechanical design, drafting, and construction supervision on power plant work. Answer to

P-1281, Power
520 North Michigan Ave., Chicago 11, Ill.

WANTED

STEAM-ELECTRIC CHIEF

Graduate Engineer, for New York consulting and designing firm, responsible charge design of steam-electric power plants, piping, electrical and sub-stations. Hydro-electric, public utility and industrial experience desirable. Please furnish detailed experience record and indicate what following of subordinates possibly available. Replies strictly confidential.

P-1293, Power
330 West 42nd St., New York 18, N. Y.

WANTED

POWER PLANT MECHANICAL ENGINEERS

Thoroughly experienced in design of modern plants and qualified to supervise engineering staff. Annual salary in neighborhood of $10,000. Location in greater New York area. Give full details of education, experience, age, availability, willingness to travel, etc.

P-1317, Power
330 West 42nd St., New York 18, N. Y.

MECHANICAL ENGINEERS
WITH 5 TO 15 YEARS EXPERIENCE
In Design of Steam Electric Generating Stations or Gas Plants
Write to
MECHANICAL ENGINEER
PENNSYLVANIA POWER & LIGHT CO.
Allentown, Pa.

MECHANICAL ENGINEER
WITH 15 TO 20 YEARS EXPERIENCE
In The Design of Steam Electric Generating Stations
FOR ADMINISTRATIVE POSITION
With a Large Eastern Utility
P-1261, Power
330 West 42nd St., New York 18, N. Y.

CIVIL SERVICE

EMPLOYMENT OPPORTUNITIES in the Navy Dept.—east and west coast areas—for scientists and technicians: For current vacancies consult the Scientific Personnel Bulletin Employment Series of the Office of Naval Research on file at Naval societies, scientific journals, regional offices of the U. S. Civil Service Commission, etc., or address specific inquiries stating qualifications to the Scientific Personnel Branch, Navy Dept., Washington 25, D. C.

POSITIONS VACANT

WANTED—CHIEF Electrician—familiar with all electrical installation and maintenance of Diesel Power generating industrial plant. Nylen Products Company, St. Joseph, Michigan, phone 3-1528.

POWER PLANT Supervisor, Texas, age 40 to 50, must be skilled in operation and maintenance of turbines and gas fired boilers. P-327, Power, 520 N. Michigan Ave., Chicago 11, Ill.

GRADUATE MECHANICAL Engineer wanted: Must be experienced in operation and management of modern steam plant, and capable of supervising operating personnel. Permanent position with well known electric utility in Northwestern Ohio. Write full particulars about age, experience, salary requirements to P-329, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED CHIEF engineer for new milk products plant being constructed in southern Michigan town. Will have charge of electric generator equipment, steam generating equipment, refrigeration and maintenance throughout entire plant. College education not necessary, but preferred. Age, not over 35 years. P-1050, Power, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEERS for permanent work with established consulting engineering firm in Midwest. Apply by letter giving full information and statement of availability. P-1250, Power, 520 N. Michigan Ave., Chicago 11, Ill.

(Continued on page 289)

SALES REPRESENTATIVE

Salary basis, for New York City and vicinity. Age under forty. Must have experience in sale of accessories for steam plants or similar position requiring acquaintance with power boiler operation and maintenance. Rare opportunity for salesman with executive aptitude to affiliate with thirty-year-old manufacturer. *Write Sales Manager.*

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Boston 36, Massachusetts

DESIGNERS

MECHANICAL—STRUCTURAL —ELECTRICAL

With experience on design for Commerical and Industrial Buildings, including Chemical Plants, Power Plants and Laboratories.

MECHANICAL — Designers and checkers for Air Conditioning Pressure Vessels, Process and Power Piping, Plumbing, Sewer and Underground Piping.

STRUCTURAL — Designers for Structural Steel and Reinforced Concrete. Must be capable of checking drawings.

ELECTRICAL — Designers for Power and Lighting Layout.

Applicants for Design positions should be willing to perform board work in connection with their own designs.

Openings in our Cleveland and New York Offices.

Lengthy employment offering good salary for those who qualify.

Send complete resume stating experience, education, salary requirements and date of availability to either of the following addresses

THE H. K. FERGUSON COMPANY
Engineers and Builders
FERGUSON BUILDING
East 11th and Walnut, CLEVELAND, OHIO
or
19 Rector Street, New York, N. Y.

WANTED

WATER TREATMENT ENGINEER

Mechanical or chemical engineering graduate, under 32, familiar with design and operation of industrial water treatment—for boiler and cooling applications. Practical field experience with consultants, or in power plants, is desirable. For central staff engineering division of large Midwestern corporation. Reply, giving full details of age, education, experience, and salary desired. Replies held in confidence.

P-1220, Power
520 North Michigan Ave., Chicago 11, Ill.

POSITIONS VACANT

(Continued from page 288)

WANTED—SUPERVISING graduate mechanical engineer for national chain of hotels. Should be experienced in hotel construction, design of all mechanical equipment, heating, ventilating, lighting, air conditioning, refrigeration, and plumbing. Should be able to write specifications for all branches of work as well as estimate costs. Give full details of experience and salary desired. P-1247, Power, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER, experience high pressure boiler plant and auxiliaries design, layout specification. Should be capable taking charge of several draftsmen. Permanent. Consulting engineering firm in midwest. P-1008, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WATCH ENGINEERS. New England utility needs operators for turbo-electric power plant. Experience burning fuel oil essential. State qualifications and references in first letter. P-1227, Power, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICES

SALARIED POSITION $2,500-$25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixbxy, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

ENGINEER—DESIRES position in Southwest. Texas, Oklahoma, Missouri, Louisiana, Ohio, Illinois, preferred. Four years experience with oil and gas fired boilers, low and high pressure. Feed water treatment. Maintenance and upkeep of boiler room auxiliaries and boiler. Some sales experience. Age 22. Married. Will send full details, references and picture on request. PW-331, Power, 68 Post St., San Francisco 4, Calif.

INDUSTRIAL POWER house superintendent three years college Mechanical engineer, seventeen years power house experience, Seven years as service engineer with large boiler manufacturer. Five years as maintenance and operation supervisor in large chemical plant. Experienced in pulp, coal and stoker firing, quantity feed water treatment and power generation. Now employed, desire change. Address: PW-1140, Power, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER

Well known engineer now serving as a Consultant in Eastern City wishes to locate in West or the Southwest of the United States. Over twenty years experience in industry both in electrical and mechanical capacity. Will be glad to furnish complete resume of experience and references to interested concerns or corporations.

Reply to

PW-1280, Power
330 West 42nd St., New York 18, N. Y.

WIRE and CABLE

BOUGHT AND SOLD

● Substantial quantities of new insulated copper wire in all voltages and almost any constructions now available.

Send us your inquiries or offerings—Eastgate 4777.

UNIVERSAL WIRE and CABLE CO.
2110-32 No. Racine Ave. Chicago 14, Ill.

FOR IMMEDIATE DISPOSAL

COMPLETE

TURBINE-ELECTRIC GENERATING PLANT

Now located in East Newark, N. J.

Turbine—7500 KVA, G. E., 175 pound pressure, condensing, 1800 rpm, Form T.
Generator—7500 KVA, G. E., 1800 rpm, 600 volts, 3 phase.
Exciter—steam driven, Allis Chalmers, 250 rpm, 120 volts.
Transformers—4-1250 KVA, G. E., 550 volts to 6600 volts, Type H.
Alberger Condenser and all other necessary auxiliaries.

For Further Particulars and Inspection write

FS-326, Power
330 West 42nd St., New York 18, N. Y.

Wanted INDUSTRIAL ENTERPRISE CASH PAID

By **FOR CAPITAL STOCK or ASSETS**

large financially powerful diversified organization wishing to add another enterprise to present holdings
Existing Personnel Normally Retained
STRICTLY CONFIDENTIAL
Box 1234, 1474 B'way, N. Y. 18, N. Y.

FOR SALE

DETROIT ROTO STOKER

1 New, unused stoker. Designed for 600 HP B & W boiler. Guaranteed 200% rating. Three 27" rotors, 13 x 9', stationary grates, complete for installation. Purchasing power reason for selling.

GOODMAN LUMBER CO.
Goodman, Wisconsin

WANTED

WANTED

TURBO-GENERATOR

Aprox 2500 KVA 2300/3/60 180# pressure 20# + or — Extraction.

Not over 20 years old

EVANS PRODUCTS COMPANY
Coos Bay, Oregon

WANTED

Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-978, Power
330 West 42nd St., New York 18, N. Y.

WANTED

Wanted New York City complete 1100 Kw plant. 2—400 Kw, 1—300 Kw, 60 cy, 3 ph, 4 wire, turbo, steam or Diesel engine generators. Voltage 2300 or 220 80% P. F. Preferably 1—400 Kw turbo generator noncondensing, 150 lbs. initial and 15 lbs. back pressure. One condensing unit 400 Kw. Could use 500 Kw units. The 300 Kw unit could be either condensing unit or Diesel medium speed. Also required swbd, piping, condensers and auxiliary equipment for a complete plant. If 2300 volt units are offered then 13—100 KVA transformers will be required. Also another location; 3—60 cy, 3 ph pnits, size 1000 Kw units or 2—1000 and 1—600 Kw, also 4 boilers 225 lbs., 30,000 #/hr each; piping, swbd, wiring connection, auxiliary equipment, condensers for 1000 Kw, etc.

PERCIVAL R. MOSES & ASSOCIATES
11 Park Place, N. Y. 7, N. Y.

Additional

Wanted Advertisements

on pages 311 and 320

WANTED

TWO (2) DIRECT CURRENT MOTOR

175 H.P., type DMC class 209 500 RPM form L 230 volts. Reply

W-1271, Power
330 West 42nd St., New York 18, N. Y.

ROLLING UP NEW RECORDS FOR REAL VALUES!

HEMPHILL EQUIPMENT

REBUILT AND TESTED BY OUR ELECTRICAL ENGINEERS TO N.I.S.A. STANDARDS

MOTOR GENERATOR SETS

1—500 KW General Electric MPC, 230 v., 720 RPM, AT1, 2200/4150 volt, 3 phase, Syn.
1—125 KW Crocker Wheeler 125V, 1200 RPM, 2300 V., Squirrel Cage.
1—100 KW Elec. Mach. 125 V., 1200 RPM, 4150 volt, synchronous.
1—100 KW General Electric, 230 v., 900 RPM, TS 4150 v. syn.
1—50 KW Ridgeway 1200 RPM, 550 Volt, Motor Sq. Cage, 220 volt.
1—17 KW Allis Chalmers, 3 Unit, 125 Volt, Sq. Cage, 1800 RPM.
1—5 KW General Electric, AC Gen., 1800 RPM, 120 volt, single phase, DC Motor, 230 volt.

ENGINE GENERATOR SETS

1—150 KVA General Electric, Ames Uniflow 220 volt, 3 phase, non-condensing.
1—62½ KVA Westinghouse 240 volt, 3 phase, Fairbanks non-condensing.
2—13 x 15 Uniflow Engines 150/300 RPM for Ice Compressors.
1—200/273 volt Gasoline Van Bierck 8 cyl. 1500 RPM.

TURBO GENERATOR SETS

1—300 KW General Electric ATB 240 Volt, 3 phase, condensing.
1—60 KW, General Electric DC 125 volt, 3600 RPM, Elliott Turbine.
1—30 KW Allis Chalmers 3600 RPM, 125 volt, Terry Non-Condensing.

TRANSFORMERS

3—150 KVA General Electric, Type HT, 3 phase, 27080 Primary, 125/216Y Secondary.
1—200 KVA Pittsburgh 4000 volt, single phase 110/220 volt secondary.
2—100 KVA Westinghouse, 13200 volt, 250 volt, single phase.
2—100 KVA Westinghouse 11430 volt, 250 volt, single phase.
10—27½ KVA General Electric brand new Air Cooled 440/220 220/110 single phase.
3—10 KVA Westinghouse Air Cooled, 450 volt, primary, 117 Volt secondary, single phase.
1—7½ KVA Westinghouse, 2200 volt primary, secondary 220/440 220/110, single phase.
1—7½ KVA American 2200 volt primary, 230 volt, single phase.
1—7½ KVA Maloney 440 volt primary 110/220 secondary, single phase.

A. C. GENERATORS

500 KW General Electric .8 PF, 3600 RPM, ATB, 600 RPM, DC exciter.
240 KW General Electric .8 PF, 600 RPM, ATB, 600 RPM, DC exciter.
200 KVA Allis Chalmers, 3600 RPM, 240 volt, 2 phase, DC exciter.
200 KVA Westinghouse 600 RPM, 240 volt, 3 phase, DC exciter.
200 KVA Allis Chalmers, 900 RPM, 240 volt, 3 phase, DC Exciter.
180 KW Westinghouse, 514 RPM, .8 PF, 550 volt, 3 phase.
2—167 KVA General Electric, 1200 RPM, .6 PF, 450 volt, 3 phase.
165 KW Electric Machinery, 514 RPM, 2400 volt, 3 phase.
120 KW, General Electric, ATB, .8 PF, 720 RPM, 2300 volt, 3 phase.
100 KW, General Electric, ATB, 600 RPM, 240 volt, 3 phase, DC Exciter.
62½ KW Allis Chalmers, 3600 RPM, 220 volt, 3 phase, DC Exciter.
35 KW Columbia Elect. .8 PF, 1200 RPM, 240 volt, 2 phase, DC Exciter.
31.3 KVA American Customs .8 PF, 1200 RPM, 120/208 volt, 3 phase, DC Exciter.
12.5 KVA Westinghouse .8 PF, 1200 RPM, 240 volt, 3 phase, DC Exciter.

SYNCHRONOUS MOTORS

200 HP Elec. Machinery, 450 RPM, 440 volt, 3 phase.
2—160 HP Electric Machinery, 1800 RPM, 2200 volt, 3 phase, DC Exciter.
150—HP Westinghouse, 900 RPM, 4150 volt, 3 phase DC Exciter
153 HP General Electric, T.S. 900 RPM, 4160 volt, 3 phase, DC Exciter.
100 HP General Electric T.S. 600 RPM, 440 volt, 3 phase, DC Exciter.
70 HP Electric Machinery, 180 RPM, 2200 volt, 3 phase.
40 HP Westinghouse, 1800 RPM, 220 volt, 3 phase, DC Exciter.
35—HP General Electric, 1200 RPM, 2200 volt, 3 phase, DC Exciter.
20 HP Westinghouse, 1800 RPM, .8 PF 220 volt, 3 phase.

MOTORS—3 ph. 60 cycle

SQUIRREL CAGE

1—450 HP Ridgeway 900 RPM, 2200 volt, 3 phase.
3—40 HP General Electric, Type KT, 900 RPM, 220 volt, 3 phase.
1—35 HP General Electric, Type 1, 600 RPM, 350 volt, 3 phase.
2—10 HP Westinghouse gear 440 RPM output 440 volt, 3 phase.

MOTORS—3 ph. 60 cycle

SLIP RING

1—450 HP General Electric, 425 RPM, ITC, 440 volt, 25 cycle.
1—100 HP General Electric, 720 RPM, IM, 440 volt, 25 cycle.
1—50 HP F & B, 1800 RPM, BV, 220 volt.
1—50 HP General Electric, 900 RPM, IM, 440 volt.
1—40 HP Cont. 1150 RPM, SA55, 220 volt.
1—40 HP General Electric, 1130 RPM, MT, 220 volt.
1—40 HP General Electric, 900 RPM, MT, 220 volt.
1—40 HP, General Electric, 900 RPM, MT, 2200 volt.

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

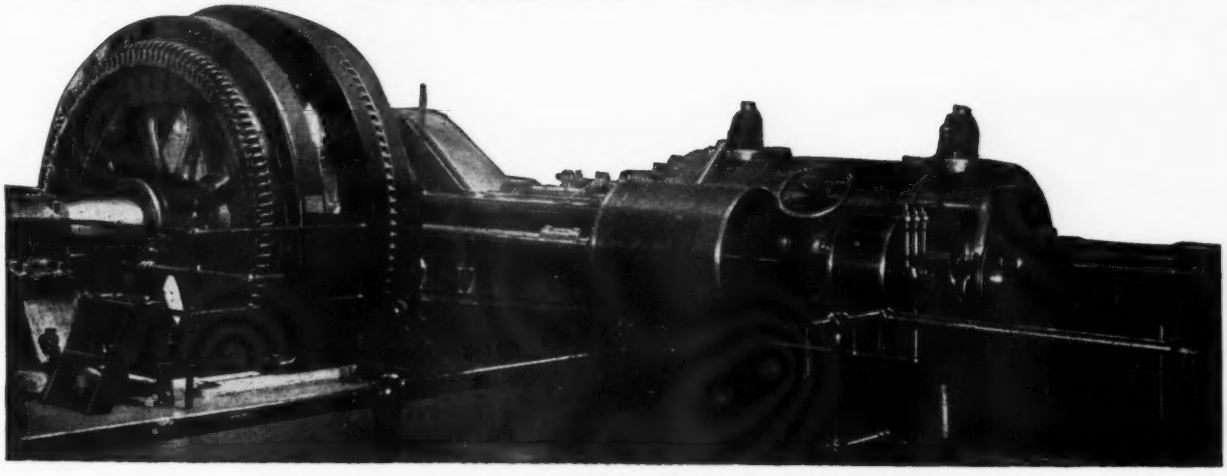
J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY



750 KVA NORDBERG UNIFLOW ENGINE GENERATOR UNIT

600 KW 80% P. F. 750 KVA General Electric alternating current generator, 3 phase, 60 cycle 4000/2300/600/480/240 volts, 150 RPM, direct connected to Nordberg uniflow noncondensing engine, 150–200# steam pressure, 0–15# backpressure. This unit is in excellent condition, available for immediate delivery.

CONDENSING TURBO UNITS

3 phase 60 cycle

12500 KVA Wstgh. 2400 v. 200# steam
5000 KVA G.E. 2400 volts 200# steam
3750 KVA G.E. 480 volts 150# steam
3750 KVA Wstgh. 4160 v. 200# steam
2500 KVA G.E. 480 volts 150# steam
2250 KVA G.E. 480 v. 250/400# steam
1563 KVA Allis 2400 volts 200# steam
1250 KVA G.E. 480 volts 150# steam
1250 KVA G.E. 600 volts 250# steam
937 KVA G.E. 480 volts 150# steam
375 KVA G.E. 480 volts 400# steam

DIESEL UNITS

3 phase 60 cycle

1250 KVA General Motors 2400 v 720 RPM
575 KVA McIntosh-Sey. 2400 v 225 RPM
500 KVA Fairbanks-Morse 2400 v 400 RPM
432 KVA Worthington 2400 v 360 RPM
365 KVA Worthington 2400 v 360 RPM
250 KVA Fairbanks-Morse 2400 v 257 RPM
185 KVA Fairbanks-Morse 2400 v 300 RPM
100 KVA F. M. 2400 v 300 RPM

BOILERS

175,000 lbs. /hr Combustion Engineering 450 lbs. steam, pulverizer
90,000 lbs/hr Combustion Engineering 550 lbs. steam, 700 deg. TT., pulver.
50,000 lbs/hr Springfield 225 lbs. steam, 500 deg. T.T., pulverizer
37,500 lbs/hr Heine 400 lbs. steam, 620 deg. T.T., oil burner
35,000 lbs/hr Foster Wheeler 325 lbs. steam, 570 deg. T.T., oil burner
30,000 lbs/hr B & W 525 lbs. steam 600 deg. T.T., pulverizer

NONCONDENSING TURBO UNITS

3 phase 60 cycle

2500 KVA G.E. 480 volts 150# steam, 15# exhaust
1875 KVA Wstgh. 2400 volts 200# steam, 10# exhaust
1563 KVA Kerr 2400 volts 200# steam, 15# exhaust
937 KVA Moore 2400 volts 175# steam, 20# exhaust
937 KVA Wstgh. 480 volts 400# steam, 60# exhaust
750 KVA G.E. 480 volts 115# steam, 5# exhaust
625 KVA Wstgh. 480 volts 300# steam, 10# exhaust
375 KVA G.E. 240 volts 150# steam, 10# exhaust
250 KVA G.E. 480 volts 200# steam, 5# exhaust
187 KVA G.E. 480 volts 250# steam, 15# exhaust

MOTOR GENERATOR SETS

3 phase 60 cycle

1800 KW G.E. 125/250vD.C., 4000 v A.C.
1000 KW G.E. 250 v D.C., 2300/4000 v A.C.
500 KW Elliott 250 v D.C., 2200 v A.C.
200 KW C. W. 125 v D.C., 2200 v A.C.
150 KW Wstgh. 250 v D.C., 4000 v A.C.
125 KW G.E. 250 v D.C., 440 v A.C.
100 KW Elliott 250 v D.C., 2200 v A.C.

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW G.E. 225/285 v D.C., 13,800 v A.C.
2000 KW Allis 600 v D.C., 4150 v A.C.
1500 KW Wstgh. 600 v D.C., 4000 v A.C.
1500 KW Wstgh. 250 v D.C., 2300 v A.C.
1000 KW Wstgh. 250 v D.C., 2300 v A.C.

EXTRACTION TURBO UNITS

3 phase 60 cycle

3750 KVA Wstgh. 2400 volts 150# steam 10# extraction
1875 KVA G.E. 480 volts 225# steam 15# extraction
1250 KVA Allis 480 volts 300# steam 35# extraction
940 KVA Wstgh. 600 volts 150# steam 20# extraction
625 KVA Wstgh. 480 volts 250# steam 25# extraction

UNIFLOW UNITS

3 phase 60 cycle

750 KVA Skinner, 2400 volts, 175# steam, 15# exhaust
375 KVA Skinner, 2400 volts, 150# steam, 5# exhaust
200 KVA Skinner, 240 volts, 150# steam, 5# exhaust
150 KVA Ames, 240 volts, 150# steam, 5# exhaust

UNIFLOW UNITS

250 Volts Direct Current

750 KW Skinner, 150# steam, 5# exh.
500 KW Skinner, 150# steam, 5# exh.
300 KW Skinner, 150# steam, 5# exh.
250 KW Skinner, 150# steam, 5# exh.
200 KW Skinner, 150# steam, 5# exh.

GENERATORS

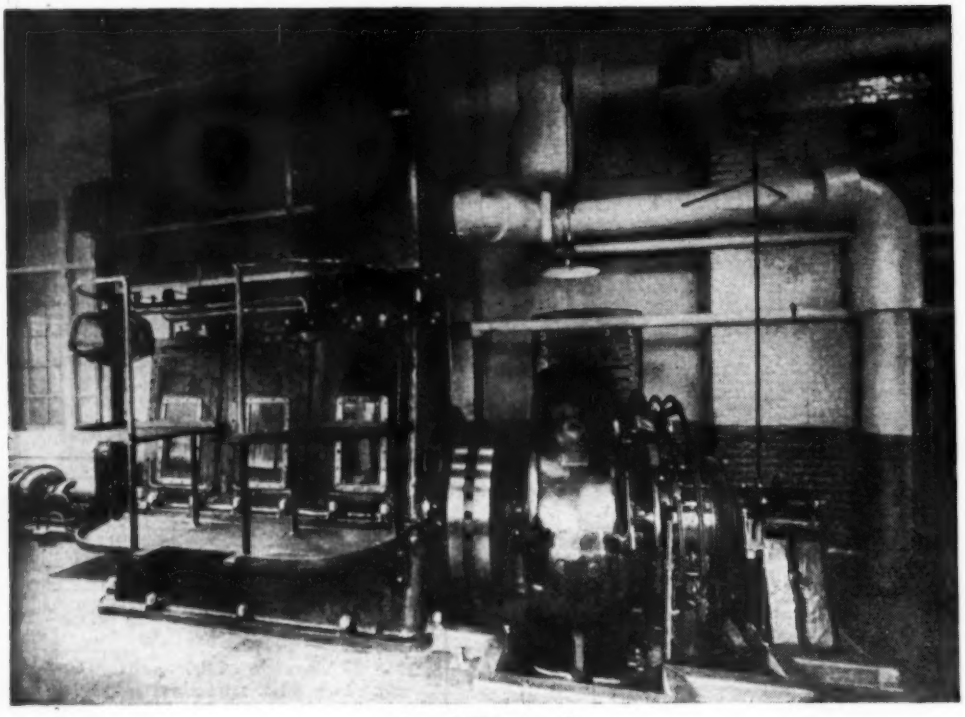
3 phase 60 cycle

2000 KVA G.E. 480 volts, 300 RPM
1500 KVA G.E. 600 volts, 300 RPM
1250 KVA G.E. 2400 volts, 720 RPM
1150 KVA Wstgh. 600 volts, 400 RPM
1000 KVA G.E. 2400 volts, 720 RPM
937 KVA G.E. 480 volts, 1200 RPM
750 KVA G.E. 480 volts, 1200 RPM
650 KVA G.E. 600 volts, 360 RPM
625 KVA Wstgh. 2400 volts, 720 RPM

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone Main 9514** **CLEVELAND 14, OHIO**

400 KW DIRECT CURRENT SKINNER UNAFLOW ENGINE GENERATOR UNIT



Actual Photograph

400 KW maximum—325 KW, 35°C. Crocker-Wheeler 125 volt, 300 RPM interpole direct current generator direct connected to a 15" x 14", 3 cylinder, 300 RPM Skinner vertical Unaflow non-condensing engine, 125 to 150 lbs. pressure, 0 to 5 lbs. gauge back, complete with switchboard.

Excellent Condition

Complete Installation

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, complete surface condenser, exciter.

1875 KVA Westinghouse condensing, 175 to 200 lbs. pressure, 500°TT, 480 volts, complete.

625 KVA Westinghouse automatic bleeder condensing, 250 lbs. pressure, 20 lbs. gauge back, 480 volts, complete condenser and panel.

625 KVA G.E. condensing, 200 lbs. pressure, 2300 volts, complete exciter, condenser, switchboard.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lb. back, 2300 volts, complete exciter, panel.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts, with exciter, panel.

125 KVA G.E. non-condensing, 175 lbs. pressure, 10 lbs. gauge back, 2300 volts, complete

100 KVA Westinghouse non-condensing 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts.

ENGINE-GENERATOR UNITS

Alternating Current
3 phase, 60 cycle

750 KVA G.E. 2300 volts, 150 RPM generator direct connected 28" x 32" Chuse Unaflow engine.

500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pres.

312 KVA G.E. 480 volts, 180 RPM generator direct connected to 24" x 20" Skinner Universal Unaflow engine, 175 to 200 lbs. pressure.

225 KVA E.M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.

180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.

150 KVA G.E. 240 volts, 225 RPM generator direct connected to Ames Unaflow engine.

75 KVA Allis 2300/550 or 440 volts, 257 RPM generator direct connected to 12" x 16" Chuse 4-valve non-releasing Corliss engine.

ENGINE-GENERATOR UNITS

Direct Current

500 KW Crocker-Wheeler 250 volts, 150 RPM generator direct connected Ames Unaflow non-condensing engine —complete.

200 KW Burke 3-wire, 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine 150 lbs. pressure, complete switchboard.

75 KW Allis-Chalmers Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.

35 KW G. E. 125 volt, 3600 RPM non-condensing turbine-generator unit.

15 KW Crocker-Wheeler, 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

100 KW G.E. 125 volts, 1200 RPM direct current generator direct connected 150 HP, 3 phase, 60 cycle, 220 volts induction motor.

62½ KVA G.E. 3 phase, 60 cycle, 2300 volts, 1200 RPM alternator direct connected 75 HP, 115 volt direct current motor.

50 KW Westinghouse, 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt induction motor.

SPECIAL BARGAIN OFFERINGS

5425 GPM Worthington 70' head, 1800 RPM centrifugal pump direct connected 125 HP G. E. 3 phase, 60 cycle, 2200 volt slip ring motor.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

187½ KVA Ideal 3 phase, 60 cycle, 240 volt, 400 RPM alternator direct connected 225 HP Buckeye Diesel.

500 KVA Westinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM belted generator.

MANISTEE ROTARY JET CONDENSER 7000 lbs. steam per hour, 28" vacuum direct connected to a 25 HP, 3 phase, 60 cycle, 220 volt, 900 RPM G.E. motor.

10 TON CAPACITY BROWN HAND OPERATED TRAVELING CRANE with 31'0" span including 150' of I-beams.

1—Allis-Chalmers jet condenser suitable for 2000 KW steam turbine-generator unit.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO
WIRE OR PHONE
LONG DISTANCE 422

FAMOUS WORDS IN THE ELECTRICAL INDUSTRY:

"Successful Operation Guaranteed"

WHAT MORE CAN YOU ASK?

RE-NU-BILT EQUIPMENT

RE-NU-BILT BELYEA MOTORS

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1000 KW Al. Ch. 450 V. d.c. to 1250 Kva 2300 V. Syn. Motor.
1—600 KW G.E. 3 unit with 2-300 KW 250 v. Gens. d.c. to 850 HP. 2300 v.
1—500 KW G.E. 600 V. d.c. to 700 HP—13200
1—400 KW G.E. 3 Unit with (2) 200 KW 125 V. d.c. to 600 HP—2300 v. Syn.
1—400 KW Whse. 250 V. d.c. to 600 HP—440 V. Syn. with exciter.
1—300 KW G.E. 550 V. d.c. to 435 HP—2300/4000 Syn. with exciter.
1—250 KW G.E. 275 V. d.c. to 350 Kva 2300/4000 Syn. with exciter.
1—250 KW Al. Ch. 250 V. d.c. to 340 Kva—2300 V.
1—200 KW G.E. 125 V. d.c. to 300 HP 440 V. Syn. with exciter.
1—150 KW Whse 250 V. d.c. to 250 Kva. 440 V. Syn. with exciter.
1—150 KW Whse 600 V. d.c. to 225 HP—2300 V.
1—75 KW G.E. 125 V. d.c. to 120 HP—4000/2300 V. Ind.
2—48—KW G.E. 3 unit with (2) 24 KW, 60 V. gens. d.c. to 75 HP, 440 V. Ind.
1—35 KVA Whse. 240v., 3 ph., 60 cy. A.C. gen. with 35 HP—230 V. d.c. motor.

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V. 3 ph. 25 Cy. Motor and 1000 KW—2300 V—8 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V. 3 ph. 25 cycle motor and 1200 Kva.—.7 pf. 2400 V. 3 ph. 60 cycle gen.

1—600 KW—GE—2 Unit Consisting of 850 HP—2300 V—3 ph. 25 Cycle Motor and 750 Kva.—.8 pf.—2300 V—3 phase—62½ cycle generator.

1—150 KW—Induction type, 2 Unit 4 Bearing—Generator 150 KW—type ITT—557—1800 RPM—500 Volt 3 ph. 120 cycle—Stator excitation 440 Volts with 100 HP—1800 RPM—440 Volt 3 phase 60 cycle Sq. Cage Motor

ROTARY CONVERTERS

60 cycle

KW	Make	Speed	Volts	Volts
1—1500	Whse.	720	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	Whse.	1200	600	13200

TURBO-GENERATOR SETS

1—5000 KVA G.E. 2300 V. 3 ph. 60 cy. with G.E. 435 lb. Condensing turbine.
1—3000 KW Whse. 3750 Kva. 2300 V. 3 ph. 60 cy. with Parsons 200 lb. Cond. turbine.
1—3000 KW G.E. 3750 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.
1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—2000 KW G.E. 3125 Kva. 480 V. 3 ph. 60 cy. with 175/200 lb.; 25 lb. auto extraction.
1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
2—1250 KW G.E. 1560 Kva. 2300 V. 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.
1—1250 KW G.E. 600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.
1—1000 KW G.E. 1250 Kva.—2300 V.—3 ph. 60 cy. with G.E. 125 lb. and 16 lb. mixed pressure Condensing turbine.
2—1000 KW G.E. 1250 Kva.—2300/4100 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.
1—500 KW G.E. 625 Kva.—240/480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. with Parsons 145/175 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 80/100 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb., 10 lb. back pressure turbine.
1—300 KW Whse. 375 Kva. 480 V. 3 ph. 60 cy. with Whse. 250 lb., 5 lb. back pressure turbine.
1—300 KW Al. Ch. 120/240 V. d.c. geared to Whse. 440 lb. Cond. turbine.
1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non cond. turbine and exciter.
1—125 Kva. G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
1—100 Kva. Whse. 2400 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
1—100 KW G.E. 600 V. 3 ph. 60 cy. with 200 lb. non-cond. turbine and exciter.

SPECIAL

500 HP — GE — KF-559 — 3575 RPM — 2300 Volt Sq. Cy. Motor connected to Byron Jackson 325 GPM—10 stage 3500 ft. head pump.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—2100	G.E.	ATI	2300/4600	514
2— 600	Al. Ch.		2300	720
1— 600	G.E.	TS-7640	2300	900
1— 600	G.E.	ATI	600	900
2— 350	G.E.	TS	2200	150
1— 300	Whse.		600	600
1— 200	El. Mach.		440	900
1— 200	G.E.	TS-965	2300	720

SLIP RING

1—1000	Whse.	CW	2300	705
1— 800	Whse.	CW	6600	443
1— 750	Whse.	CW	2200	327
1— 450	Cr. Wh.	SR-310	2300	392
1— 350	G.E.	MT-442Y	2200/4000	253
1— 250	G.E.	MT-424Y	4000	257
1— 100	Al. Ch.	ANY	220	435

SQUIRREL CAGE

2—800	Whse.	CS-1221A	2200	706
1—250	G.E.	IK	440	600
1—250	Al. Ch.	AN	220	1160
1—150/70	G.E.	IK	440	1170/870
1—100	G.E.	IK (Vert.)	2300	450
3—100	G.E.	IK	2200	600
1—100	Al. Ch.		2200	1755

SPECIAL
MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V. D.C. Form C with 2300 V. 60 Cycle transformer and switching equipment.

1—500 KW—GE—Type RHW — 6 Anode 575 V. D.C. Form B with 2300 V. 60 Cycle transformer and switching equipment.

D. C. MOTORS

HP	Make	Type	Volts	Speed
2—800/1000	Whse.		450	600/720
1—800	G.E.	MPC	600	600
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
2—350	G.E.	MPC	250	450
1—335	Whse.	MQ	250	300/900
1—300	G.E.	DMC	230	400/600
1—300	G.E.	MPC	230	275/550
1—250	G.E.	MPC	230	400/500
1—150	G.E.	MPC	230	250/450
1—130	Cr. Wh.	CMC-51H	550	1200
2—125	G.E.	CO-1832	230	625
1—125	Whse.		240	240/600

D. C. GENERATORS

KW	Make	Type	Volts	Speed
1—1200	Al. Ch.	MHC	525	750
1— 300	G.E.	MPC	250	525
1— 155	G.E.	MPC	250	720
1— 150	G.E.	MPC	125	200
2— 100	Whse.		240	250

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Also N. Y. City Line—Rector 2-7150

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SINCE 1910—EQUIPMENT THAT PERFORMS!

1 YEAR GUARANTEE

125 V. - 250 V. - 550 V. D.C. GENERATORS
(Motor Driven and Belted)

KW	Make	Voltage	Ampere	Speed
300	G.E.	250	1200	720
250	G.E.	125	2000	690
200	G.E.	125V	1600	900
200	Cr. Wh.	550	363	900
175	Cr. Wh.	250	700	1200
150	G.E.	250	600	580
150	G.E.	125	1200	1200
150	West.	250	600	1150
100	G.E.	250	400	900
100	G.E.	125	800	730
100	G.E.	125	800	1150
40	G.E.	250	160	1150
40	Century	125	320	1450
40	West.	250/125	160	1500
40	G.E.	250	160	800
25	Allen	110	320	500
30	G.E.	250	120	1750
20	Delco	125	160	1200
20	Col. (3)	125	160	1750
15	G.E.	125	120	1750
15	West.	230	60	1450
15	G.E.	125	120	1150
15	G.E.	125	120	850
12½	F.M.	125	100	1450
10	Rogers (2)	125	80	1450
10	El. Dy.	125	80	600
8	G.E. (2)	125	64	1800
7½	G.E.	125	60	1800
5	G.E. (2)	125	40	1740
5	Rel.	250	20	1725

80—Additional generators—125 V. up to 200 V. generators in stock.

600 H.P. Westinghouse Synchronous Motor, 900 RPM, 3 ph. 60 cy. 2300 volts Complete Manual Red. Volt. Starting—Latest type

LOW VOLTAGE D.C. GENERATORS

KW	Make	Voltage	Ampere	Speed
75	G.E.	75	1000	1145
22½	West.	75	300	720
90	Century	60	1600	1150
1-½	G.E.	60	19	1800
3	Hertner	60	60	1730
40	G.E. (6)	50	800	1160
3½	G.E.	42	205	1800
5	Diehl	40	125	1750
33	G.E.	33	1000	850
39	G.E.	32	1200	1750
6½	G.E.	32	205	1800
3	G.E.	30	100	1200
6	Star (2)	25	250	1800
5	Star	25	200	1750
15	Rel.	24	625	1450
4	Star	20	200	1800
1	West.	16	60	1750
11	Star	15	750	1200
1	Cont. (2)	15	67	1750
4½	Star	15	300	1800
30	Columbia	8-16	5000/2500	720
12	H.V.W.	12/24	1000/500	900
12	H.V.W.	6/12	2000/1000	720
6	Columbia	6/12	1000/500	1200

300—Additional low voltage generators in stock.

NEW MOTORS IN STOCK

1 HP. to 30 HP.
3 ph. 60 cy. 220/440 V.
1200 & 1800 RPM
Ball Bearing
Nema Frames

230 V. D. C. MOTORS

Qu	H.P.	Make	Type	Speed
1	125	G.E.	RC	1750
1	100	West.	SK-1 0	625
1	100	Rel.		475/635
1	100	Rel.	1050T	400/1200
1	75	West.	SK	475
1	75	Cr. Wh.	New	480/670
1	75	Cr. Wh.	CMC	375/750
3	60	West.	SK-160	680
1	60	G.E.	C	480/1100
1	45	Diehl	K-10	850
2	40	G.E.	DLC-25	1050
8	40	G.E.	CD1441	250/1500
1	40	Cr. Wh.	CCM	700
1	35	G.E.	RLC-204	440/800
1	35	G.E.	RF	500/1500
1	35	West.	SK-160	400
1	30	G.E.	RC-32	1100
1	30	West.	S-6	1025
1	30	West.	SA	975
2	30	West.	SA	500/1500
2	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Rel.	92T	1150
1	25	West.	SK	900
4	25	G.E.	RF-1	500/1500
1	25	West.	SK	500/1500
1	25	G.E.	RF-11	500/1500
2	25	G.E.	RF-14	300/1200
1	25	G.E.	RF-14	300/900
1	25	West.	SA	325/975
1	20	G.E.	CD-85	1150
1	20	G.E.	RC-11	1150
1	20	West.	SK-103	1200
1	20	West.	S-6	975
2	20	West.	SK-83	850
1	20	G.E.	RC	800
1	20	Al. Ch.	Series	625
1	20	West.	HY-6	700
1	20	G.E.	RF-11	500/1500
10	20	G.E.	RF-12	400/1200
2	20	Star	SHB-20	29.2
2	16/25	Cr. Wh.	35-JA	400/1200
1	15	Roch.		3450
4	15	Star	SQ-1520	1290
1	15	G.E.	RC	1200
1	15	West.	SK-80L	1100
1	15	G.E.	RC-29	1150
1	15	G.E.	RC-10	1150
1	15	G.E.	CDC-85	900
1	15	West.	SK	850
1	15	G.E.	CDE-83	850
2	15	G.E.	RC-30	850
1	15	West.	SK	675/1350
1	15	El. Dy.	5S	600/1200

230 V. D.C. MOTORS (Cont.)

Qu	H.P.	Make	Type	Speed
1	15	G.E.	CQ	600/1500
1	15	G.E.	LC	675/1150
2	15	West.	SK-100L	600/1500
1	15	G.E.	RF-11	400/1600
1	15	West.	SK	250/1100
1	15	Diehl		200/247
1	10	G.E.	CD-75	1150
1	10	G.E.	RC	1100
1	10	Triumph	TR-10S	860
1	10	G.E.	RC-29	850
1	10	Diehl	LS-14	750
1	10	West.	SK-7L	700
1	10	Cr. Wh.	CSM	675
1	10	West.	SK	600/1200
2	10	G.E.	RLC	500/1500
1	10	G.E.	RF-10	400/1600
1	10	West.	SA	400/1200
1	10	G.E.	RF-10	400/1200
1	10	Rel.	131T	250/1000
2	10	West.	Gr. Hd.	3/10
1	7½	Sturt		3600
1	7½	L.A.	284	1750
1	7½	El. Dy.	2S	1750
5	7½	Cr. Wh.	New	1750
1	7½	G.E.	RC	1700
1	7½	West.	SK	1800
2	7½	Cr. Wh.	CCM	1425
3	7½	West.	SK	1100
1	7½	G.E.	RC	1100
1	7½	G.E.	CO-1804	1200/3200
2	7½	West.	SK-50	975
1	7½	G.E.	RC	900
1	7½	Cr. Wh.	CCM	875
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
1	8½	West.	SK-30	825
1	7½	G.E.	RF-10	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dy	3S	550/1650
2	7½	L.A.	BW-15	525/1150
1	7½	Roth	RS-107	450/900
1	7½	West.	SK-70	400/1600
1	7½	West.	SA	400/1600
1	7½	G.E.	RLC	400/1600
1	7½	Al. Ch.		350/1050
1	5	Star	SB-5	1750
1	5	Rel.	T-254	1750
2	5	G.E.	RC	1700
1	5	G.E.	CDV	1750
1	5	G.E.	CVC	1650
1	5	G.E.	CD-65	1150
1	5	Rel.	32T	1150
8	5	G.E.	RC-27A	1150
2	5	West.	SK-43	1150
1	5	G.E.	B-284	1150
1	5	West.	SC-3	870/1750
1	5	Rel.	23T	850/1700
1	5	Al. Ch.	E-75	850
1	5	G.E.	RC	600
1	5	Cont.	D-49	600/1800
1	5	Star	SB-10	600/1200
1	5	El. Dy.	3-S	550/1650
2	5	West.	SK-60	500/1500
1	5	Cr. Wh.	CM	400
2	3	G.E.	BD-235	3600

800—Smaller D.C. motors in stock including fractional.

10 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	25	Star	15-L	2400
1	25	G.E.	CDM-95	1000

110 V. D.C. MOTORS (Cont.)

Qu	H.P.	Make	Type	Speed
1	20	G.E.	CD-83	1750
1	16	Cr. Wh.	CMC-L	1750
1	15	West.		1150
1	15	El. Dy.	7½ S	615/1230
1	15	West.	S	560
4	10	Lincoln		3500
1	10	L. A.		3500
1	10	Al. Ch.	EBC-75	2175
1	10	G.E.	CD-73	1750
1	10	West.	SK-70L	850
1	10	Cont.		825
1	10	Rel.		400/1600
1	10	Diehl.		230

600—Smaller size 110 V. D. C. motors including fractional horsepower motors also in stock.

NEW

Direct Current Manual and Automatic Starters

CUTLER - HAMMER
GENERAL ELECTRIC
WARD - LEONARD

230 Volts
164—1 H.P. Manual
24—1 H.P. Automatic
197—1½ H.P. Manual
206—2 H.P. Manual
119—2 H.P. Automatic
270—3 H.P. Manual
95—3 H.P. Automatic
33—5 H.P. Automatic
11—10 H.P. Automatic
10—20 H.P. Automatic
7—25 H.P. Automatic
4—40 H.P. Automatic
3—50 H.P. Automatic
20—60 H.P. Automatic
53—75 H.P. Automatic

115 Volts
40—1 H.P. Manual
8—1½ H.P. Manual
8—2 H.P. Manual
23—3 H.P. Manual
398—5 H.P. Automatic
1—7½ H.P. Automatic
2—60 H.P. Automatic

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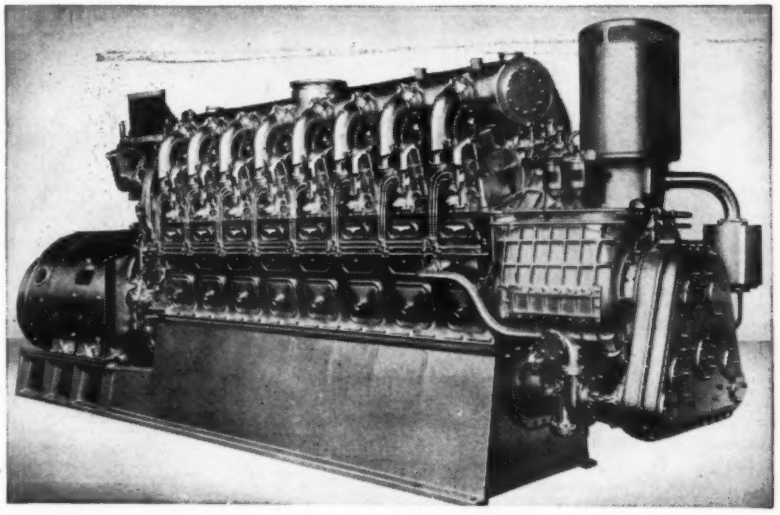

1000 KW
G. M. DIESELS

1600 HP General Motors
Model 16-278A Engines
16 Cylinder—2 Cycle—
720-750 RPM Direct Connected to
50-60 Cycle AC or
525 Volt DC Generators

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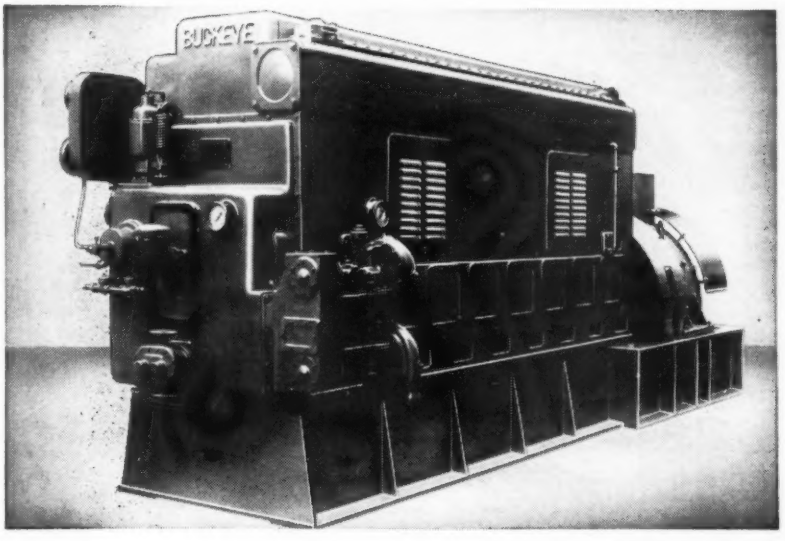

225-450 HP
BUCKEYE DIESELS

MODEL 80
4-8 Cylinder 10½ x 12
4 Cycle • 600 RPM

ALSO
COMPLETE GENERATOR PLANTS
150 - 300 KW

Diesel Generators

2-2000 HP FAIRBANKS MORSE

LATEST MODEL 33 • COMPLETE GENERATOR PLANTS 1875 KVA

HP	MODEL	KVA	RPM	NEW
1—840	Fairbanks Morse M	565	257	99%
1—450	Fairbanks Morse 33E	375	360	95%
1—360	Fairbanks Morse YVA	300	257	80%
2—240	Fairbanks Morse YVA	200	257	85%
1—180	Fairbanks Morse YVA	150	257	95%
1—80	Fairbanks Morse YVA	65	300	85%
1—375	McIntosh Seymour	350	360	85%
1—365	Ingersoll Rand S	340	600	95%
1—300	Buckeye Model E	250	400	90%
3—165	Murphy ME 650	145	1200	95%
2—150	Buckeye Model E	145	400	Unused
3—125	General Motors 6-71	75	1200	Unused

HP	MODEL	KVA	RPM	NEW
2—117	Buda LD 909	90	1200	90%
4—100	International UD 18	62.5	1200	Unused
1—90	Cummins HIS 600	62.5	1200	Unused
1—90	General Motors 6-71	60	1200	Unused
2—90	Buda	75	1200	90%
5—75	International UD 18	60	1200	Unused
4—65	International UD 14	37.5	1200	Unused
1—60	Buckeye Model J	50	600	90%
6—52	General Motors 371	37.5	1200	Unused
1—40	Buckeye Model J	30	600	90%
6—35	International UD 6	18.7	1200	Unused

Diesel Motors

WE HELP TO LIGHT AND POWER THE WORLD

PORT WASHINGTON, L. I., N. Y. **CORPORATION** **TEL: PORT WASHINGTON 2000**

Motors

. . . always a wide selection . . . always unusual values

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 200/440 Volt (Other voltage as noted)

Qu	HP	Make	Type	Speed
1	250	Al. Ch.	AN	1200
1	250	Al. Ch.	AR	1200
1	250	G.E.	KF Vert.	3600
1	150	Al. Ch.		1750
1	150	G.E.	I-17 550 Volt	400
1	150	West.	CS	345
2	125	Cr. Wh.	126Q	430
1	120	G.E.	FT	3600
1	100	Howell	SCBB	1800
1	100	G.E.	I-17I	340
1	100	G.E.	I-17A	290
2	50	R.&M.	L	1200
1	50	Al. Ch.	AN	900
1	50	G.E.	I 2200 Volt	900
1	50	F. M.		900
1	50	G.E.	I	720
1	50	West.	MS 25 Cycle	720
1	50	Wagner	BM	495
1	50	Al. Ch.		490
1	40	Al. Ch.	2200 Volt	1200
2	35	Al. Ch.	2 Phase	900
1	35	Al. Ch.		900
1	35	G.E.	I 25 Cycle	730
1	30/30	West.	CS TEFCBB	1800/900
1	30	F. M.	QZC TEFCBBEP	1200
1	30	Cr. Wh.		900
2	30	Al. Ch.	AN 2 Phase	900
1	30	Century	AS	720
1	25	West.	CS	1800
1	25	Howell		1200
1	25	F. M.	QZK B. B. New	1200
1	25	Wagner	BP	1200
1	25	Burke	EM3	900
1	25	Lincoln		900
1	25	Al. Ch.	AN	720
1	25	G.E.	M10	720
1	25	West.	MS 25 Cycle	600
2	20	U. S.	8C SPBB	1800
2	20	F. M.	QZK B. V. New	1800
1	20	West.	CS	1800
1	20	Howell	N Vert. B.B. New	1200
1	20	F. M.	KRV	1200
1	20	Cr. Wh.		900
1	20	G.E.	I-K 2200 Volt	900
1	20	Cleve.	M	900
1	20	Al. Ch.		900
1	20	West.	MS 25 Cycle	900
1	18	West.	MS (Elev.)	720
1	15	F. M.	HLS	3600
4	15	F. M.	QZK B. B. New	1800
2	15	West.	MS 25 Cycle	715
1	10	Al. Ch.		1800
1	10	Imperial	EH B. B.	1200
1	10	West.	CS 25 Cycle	725
5	7½	G.E.	KT	1800
1	7½	West.	CS	1800
3	7½	Wagner	11VRW	1800
3	7½	G.E.	KT	1200
20	3	Imperial	E (New)	1200

Approx. 200 New motors from 2 HP—30 HP.

SLIP RING & SYNCHRONOUS

3 Phase, 60 Cycle, 220 or 440 Volt (Other voltage as noted)

Qu	HP	Make	Type	Speed
1	443	El. M.	Syn.	900
1	300	G.E.	ATI Syn.	1800
1	200	F. M.	BV	600
1	150	G.E.	MT	720
1	100KW	G.E.	ATB Syn.	900
1	100	G.E.	I-16 2200 Volt	450
1	75	F. M.	BV 2200 Volt	1800
1	75	West.	(New) Syn.	1200
1	60	Ideal	AVX	1200
1	50	G.E.	I 25 Cycle	700
1	50	Al. Ch.		720
1	50	Ideal	AV 2200 Volt	600
1	40	G.E.	MT	1200
1	40	Al. Ch.		1200
1	40	G.E.	MT	900
2	40	West.	CW 2200 Volt	900
2	40	West.	CW	900
2	40	Al. Ch.		900
1	40	West.	CI	730
1	40	Burke	EMV7	1150/550
1	35	Al. Ch.		720
1	35	G.E.	I-12	600
1	30	Al. Ch.	2200 Volt	720
1	25	Cr. Wh.		1200
1	25	West.	CW	720
1	25	West.	MW	720
1	25	G.E.	MT Tot. Encl.	600
1	25	G.E.	MT	400

DC—230 Volt

Qu	HP	Make	Type	Speed
1	130	Cr. Wh.	CMC 550 Volt	1200
1	100	G.E.	CD	1200
1	100	West.	SK	1800
1	100	G.E.	RC38	600
1	100	G.E.	PCS 440 Volt	400
4	100	Cr. Wh.	CMC	225/550
4	85 KW	West.	SK Dynamometer	1200/2200
1	75	Diehl	K11	700
1	60	West.	SK 115 Volt (Vert.)	1200
1	60	G.E.	EF1	1200
3	50	West.	SK	1200
1	40	Rel.	440 Volt B. B. Vert.	1800
1	40	Rel.	440 Volt B. B. (Vert.	1200/1800
1	25/40	Cr. Wh.	CMC 440 Volt (Vert.	1200/1800
1	40	Rel.	B. B.	400/1500
2	40	West.	SK	1200
1	40	G.E.	RC	1200
7	40	West.		775
1	35	G.E.	OMTEBB	1300
1	35	West.	SK	1200
1	35	Al. Ch.		1200
1	35	G.E.	DLC	700
2	30	El. Dy.	16S	625/1250
5	30	Rel.	92TF	1800
1	30	Rel.	131T 440 Volt (Vert.)	1200
1	30	G.E.	RC	1200
1	30 KW	Al. Ch.	110 Volt	925
1	27½	G.E.	CVC116	1800
1	25	Cr. Wh.	CM 110 Volt	900/1200
1	25	Al. Ch.	E120	500/1500
1	25	Rel.	25P	250/1000
1	25	G.E.	RF	300/900
1	25	F. M.	IRC	400/800
6	25	West.	SK	1200
7	25	West.	SK	850
2	20	Rel.	131T	1000/2000
2	20	West.	SK	750/1500
1	20	Diehl	K9	500/1000
1	20	G.E.	CD	400/1600
1	20	G.E.	RF	250/1000
1	20	Lincoln	FKW B. B.	1800
6	20	Cr. Wh.	CMC Enclosed	1800

DC—230 Volt

Qu	HP	Make	Type	Speed
1	20	Cr. Wh.	CMC TEBB (Exp.)	1200
1	20	Rel.	92T	1200
2	20	West.	SK	1200
1	20	West.	SK	900
1	20	G.E.	RC	900
7	20	West.	SK	750
1	20	West.	SK	500
1	15	West.	SK63	1800
1	15	West.	SK113 Encl.	1800
1	15	F. M.	D B. B.	1150
6	15	Rel.	66T	1150
2	15	Cr. Wh.	CCM	1150
1	15	Cr. Wh.	CCM Tot. Encl.	1500
1	15	West.	SK83	1150
2	15	West.	SK80L	1150
1	15	G.E.	CD	1150
1	15	West.	SK90	850
1	15	West.	KS Crane	630
8	15	Rel.	92TF	850/1700
2	15	G.E.	CO Crane	650/2700
1	15	Rel.	131T 115 V.	600/1500
2	15	West.	SK	600/1200
1	15	Rel.	78T	400/1600
1	15	G.E.	RF11	400/1200
1	12½	West.	SK	750/1500
1	12	G.E.	RF	575/1725
1	10	West.	SK7	850/1700
2	10	G.E.	RF10	600/1800
1	10	West.	SK90	600/1800
7	10	West.	SK80L	500/1500
20	10	Al. Ch.		500/1000
1	10	Rel.	92TF	400/1600
1	10	West.	SK	250/1000
6	10	Cr. Wh.	CM TEBB	1800
1	10	Century	R304	1800
15	10	West.	SK	1150
2	10	West.	SK 115 Volt	1150
3	10	Rel.	46TF	1150
1	10	G.E.	RC9	1150
2	10	Rel.	66TF	850
2	10	G.E.	RC	850
3	10	West.	SK70	850
1	10	G.E.	RC29 550 Volt	850
1	10	Colonial		950
14	7½	West.	SK33	1750
4	7½	West.	SK60	850
20	5	West. & Gen. Elec.		1750
20	5	West. & Reliance		1150
35	5	West.	SK43	850

Hundreds of other DC motors not listed.

28 New vertical, T.E.F.C.B.B., 3 Ph, 60 Cy, 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP, ty. QZCU, Fr. 254, 1200 RPM Exp.
2—General Electric 3 HP, ty. K, Fr. 254, 1200 RPM
8—General Electric 7½ HP, ty. K, Fr. 324, 1200 RPM
8—Delco, 7½ HP, type C, Fr. 324, 1200 RPM
1—Howell, 7½ HP, type KV, Fr. 284, 1800 RPM
6—General Electric, 15 HP, type K, Fr. 365, 1200 RPM
2—Howell, 15 HP, type KV, Fr. 365, 1200 RPM

1—New General Electric 250 HP, type KF, Frame 549A, 440 volt, 3 phase, 60 cycle, 3600 RPM vert., direct connected to Bingham type 2, 22 stage, double case, 3600 RPM, 3820 head, 175 GPM

3—New Allis Chalmers 200 HP, type ARZ, 2300 Volt, 3 phase, 60 cycle, 3600 RPM, totally enclosed, fan cooled, ball bearing

1—150 KW Westinghouse synchronous M-G set, 275 volt DC, 4400 volt AC, 3 phase, 60 cycle, 900 RPM, AC control & DC panel
1—150 KW General Electric M-G set 250/275 volt DC, 440 vol AC, 3 phase, 60 cycle, 900 RPM
1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM AC control & DC panel
1—200 KW Burke synchronous M-G set, 750 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel
1—30 KW Westinghouse M-G set, 125 volt DC, 2300 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters, all control and drive motors. All motors ball bearing, enclosed. M-G set, exciters and control mounted in fan cooled enclosure. Drive motor G. E. type CD, frame 1441, 40 HP, 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont. 250 RPM, 1 hr. 50°

The Wente Electric Co.

Hamilton — Rebuilt Motors and Generators Since 1906 — PHONE HAMILTON 707 — **Ohio**

EXPERT REPAIRING AND REBUILDING OF MOTORS AND GENERATORS

✧

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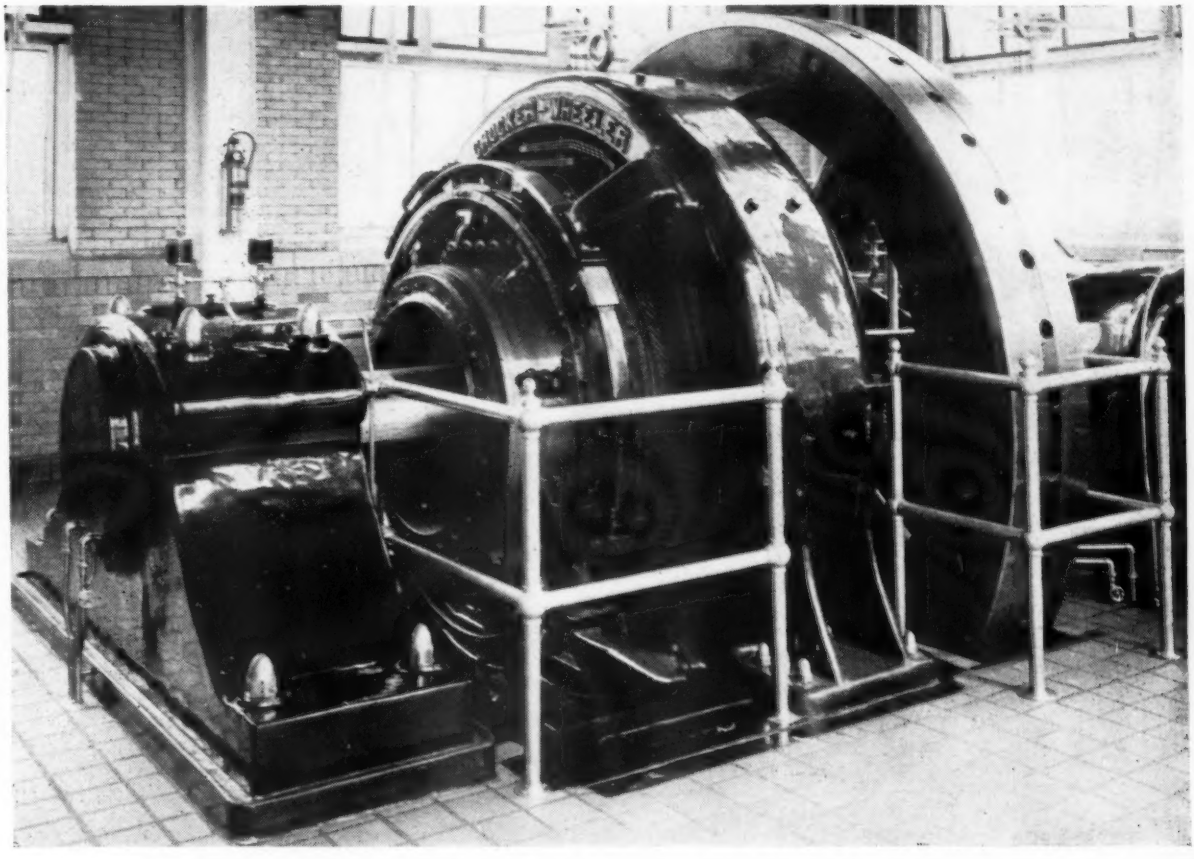
AN EXCEPTIONAL BARGAIN



500 KW Direct Current Hamilton Uniflow Engine Generator

Specifications:

Crocker-Wheeler #430085—500 KW—250 volt—150 RPM—2000 Amps.—500 KW Cont. 35° C. overload 25%, 2 hr. 50° C. direct connected to Hamilton horizontal Uniflow engine, size 26 x 30, Mfg. by Hooven-Owens-Rentschler Company

Condition:

Excellent—installed new, used only six (6) months since installation

Inspections:

Set may be inspected, observed and tested in operation for the next thirty (30) days. Unit will be dismantled after that time.

The Wente Electric Co.

GLOW ELECTRIC CO.

SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

TRANSFORMERS

General Electric Spirakore Transformers, 167 KVA, 2400/4160Y volt primary, 120/240 or 240/480 volt, secondary, 1 phase, 60 cycle, oil cooled, outdoor type.

COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

Note: Designed to be operated in series or parallel for higher voltage or current.

A. C. GENERATORS

(3 phase unless otherwise noted)

KW	P.F.	RPM	Volts	Description
3	1	1200	120	Hobart, Ball Bearing
4	1	1170	440	Westinghouse, Single Phase
7½	.6	1800	440	Electric Specialty, Ball Bearing
15	1	1800	127/220	General Electric, Single Bearing
20	.8	1800	1100	Fairbanks-Morse
20	1	1800	110	Ft. Wayne, Single Phase
25	.8	1200	208/120	Westinghouse, Ball Bearing, New
30	.8	1200	120/208	Delco
40	8	1200	220	Burke, Single Bearing
50	.8	1200	120/208	Electric Machinery, Single Bearing, 4 Wire
37½	.8	900	110/220	Starr, Single Phase
100	.8	900	200	Crocker-Wheeler
100	1	900	2300	General Electric
120	.8	257	2300	General Electric, Single Bearing
150	1	600	480	Burke
150	.8	900	600	General Electric
150	.8	600	480	Crocker-Wheele

PLATING GENERATORS

Jantz & Leist, type IP, 4000 ampere, 2 to 12 volts, 425 RPM, direct current Plating Generators with or without driving motors.

GAS ENGINE—AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM, 120 volt single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle, Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

31.25 KVA, 25 KW Westinghouse, .8 P.F., 1200 RPM, 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.

NEW DIRECT CURRENT MOTORS

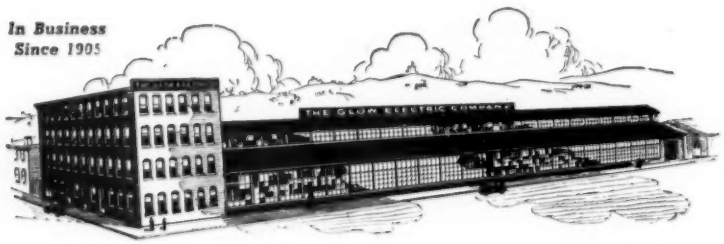
25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

MOTOR GENERATOR SETS

KW	Volts	Generator Mfgr	A. C. Motor
*600	250	General Electric	900 HP, 1200 RPM, General Electric, Synchronous
*300	250	General Electric	450 HP, 1200 RPM, General Electric, Synchronous
200	125	General Electric	300 HP, 900 RPM, General Electric, Synchronous
50	120/125	Burke	95 HP, 1200 RPM, Burke Synchronous
*50	115/230	Westinghouse	75 HP, 1800 RPM, Westinghouse, Induction
40	250	Reliance	60 HP, 1800 RPM, Century, Induction
25	125	General Electric	35 HP, 1200 RPM, Genera Electric, Induction

* These Motor Generator Sets are new.

In Business Since 1905



Late Type TURBO-GENERATOR SET

Westinghouse 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Hendy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

DYNAMOMETERS

General Electric, 50 HP, 700/2500 RPM, 250 volt, 21.008 inch torque arm. Can absorb up to 60 HP motor.

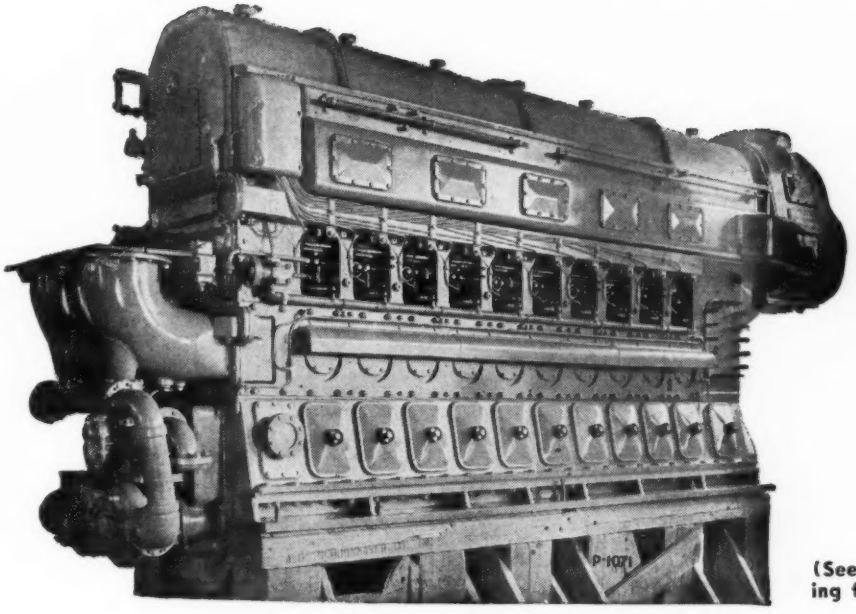
DIRECT CURRENT GENERATORS

KW	Volts	RPM	Manufacturer	Description
400	120/240	300	Westinghouse	Compound, Interpole, Pedestal Bearings
290	250	900	General Electric	Single Bearing
250	120/240	1200	Crocker-Wheeler	Compound Wound
200	125	900	General Electric	Compound Wound
200	250	1200	General Electric	Single Bearing, Compound Wound
200	250	375	Jantz & Leist	Compound Wound, Pedestal Bearings
175	250	450	Westinghouse	Compound Wound, Pedestal Bearings
150	250	900	General Electric	Single Bearing
100	240/325	1200	Elliott	Single Bearing
100	125	1200	Western Electric	Compound Wound
100	125	900	Crocker-Wheeler	Compound Wound, Pedestal bearings
80	125	500	Jantz & Leist	Compound Wound, Double Shaft Extension
80	125	400	Jantz & Leist	Compound Wound, Double Shaft Extension
30	250	300	Triumph	Compound Wound
22½	250	765	Westinghouse	Compound Wound

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC HOISTS
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

ENGINEERED AGSCO DIESEL POWER



3000 KVA PLANT CONSISTING OF:

3—1000 KVA, 800 KW, 3 phase 60 cycle, 2300 volt. Westinghouse, 600 RPM, Direct Connected to:

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8⅛, 10 cylinder, 8⅛" bore 10" stroke, 600 RPM.

(See photo at left of similar unit prior to loading from our plant #1 Jersey City.)

These three units are offered with complete equipment—switch boards, auxiliaries cooling equipment and silencing equipment.

DIESEL GENERATORS

ALTERNATING CURRENT

(60 and 50 cycles)

KVA	MAKE	HP	MODEL	RPM	YEAR
2—1875	Fairbanks Morse	2000	33E16	300	1939
1—1250	Nelseco	1500	6M1-53	300	1931
8—1250	Fairbanks Morse	1700	38D8⅛	720	1944
12—1250	General Motors	1600	16-278-A	720	1944
3—1000	Fairbanks Morse	1250	38D⅛	600	1944
1— 625	Superior	750	OS	327	1938
1— 312	Enterprise	450	D8G-8	450	New
1— 300	Fairbanks Morse	360	YVA	257	1928
.— 250	General Motors	300	8-268-A	900	New
4— 250	General Motors	400	8-268-A	1200	1945
6— 125	General Motors	200	8-268-A	1200	1944
3— 94	General Motors	125	6061	1800	New
1— 94	Buckeye	112	E	400	1936
4— 75	General Motors	90	6061E	1200	New
13— 62	International	75	UD18	1200	New
8— 37	General Motors	45	3-71	1200	New
15— 18	International	30	UD6	1200	New

What are your requirements?

Write for Bulletins

DIESEL ENGINES

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50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: WOrth 2-7225

Business Est. 1898

DIESEL POWER

AVAILABLE FOR IMMEDIATE SHIPMENT

UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM direct connected to 300 kw G.E. Alternator 3-60-2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

SKINNER UNIFLOW SET

1—300 KVA Skinner Uniflow Engine Generator Set 150# ISP 0-5# BP direct connected to Burke Alternator 3-60-480 v. 200 RPM with Exciter and Control Panel.

TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0.60# B.P.

TURBO PUMP

1—520 GPM, 50' head, DeLaval Centrifugal Pump, 2940 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0.5# B.P.

DIESEL ENGINES

1—150 H.P. Hercules 6 cyl., model DWXDS, 4¼ x 4¾.

3—68 H.P. Buda 6 cyl., model 6LD 468, size 4¼ x 5½.

AIR RECEIVERS

1—5' diam. x 14', Vertical, U-69 ASME 223.

1—6'2" diam. x 20'6", Vertical, U-69 ASME 300.

PUMPS

2—400 GPM, 635' head, Ingersoll Rand Centrifugal Pumps, size 3-GT, 3550 RPM, 350# hydro. test.

2—500 RPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—4500 GPM, 135' head, LeCourtney Centrifugal Pump, 1800 RPM.

2—520 GPM., 50' head, DeLaval Centrifugal Pump, 1150 RPM.

5—Worthington, 2⅝" x 18" Horizontal Duplex Double Acting, cap. 133 GPM, 3500# W.P.

CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 HP Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

FLANGED GATE VALVES

Stainless Steel. Sizes 1" to 6".
Iron Body. Sizes 2" to 14".
Cast Steel. Sizes 2½" to 16".

NEW HOISTS

150 Yale & Towne 2 ton Chain Hoists. 20' lift. BRAND NEW in Original Packing.

MOTORS

1—300 H.P. Westinghouse Type CS, 2200 Volt, 3 phase, 60 cycle, 600 RPM with Control.

1—200 H.P. G.E. Synchronous Motor 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

1—125 H.P. West. Squirrel Cage, 3-60-2200 v., 1800 RPM and Starter.

1—125 H.P. West. Squirrel Cage 3-60-2200 v. 3600 RPM, type CS, with Control.

1—40 H.P. General Electric Squirrel Cage, 3-60-440 v., 870 RPM, 40° C Rise, type K 342, Form B.

1—20 H.P. General Electric Induction Motor, 3-60-220 v.

5—Vertical Gear Head Motors, Crocker Wheeler TEFC 10 H.P., 220/440 Volt, 60 cycle, 3 phase, 1745 RPM, Philadelphia Gear, output 425 RPM.

TRANSFORMERS

1—7½ KVA G. E., 460/230-115 v.
1—10 KVA G. E., 2400-4160/240-480 v.
3—20 KVA West., 450-117 v. New.
6—25 KVA West., 450-117 v. New.
3—37½ KVA G. E., 4000/2300 v.
1—100 KVA West., type S, 4370-4160-3950/208-120 v.
1—250 KVA West., type SL, 4160-480 v.
1—333 KVA West., type SL, 4160/480 v.
1—500 KVA West., type SL, 4160/480 v.

300 AND 400 AMPERE ELECTRIC MOTOR DRIVEN ARC WELDERS

Lincoln—Hobart—General Electric
Reconditioned—Guaranteed—New 1943

MISCELLANEOUS

1—Accumulator, Watson Stillman, 42" diam. Air Cylinder, 11½" diam. Ram, 50" stroke, 3500 Lb. W.P.

1—3600 sq. ft. C. H. Wheeler Surface Condenser.

7—Buffalo Steel Plate Blowers, 43", type R, with Everdur Blades.

Heat and Power Co., inc.

70 PINE STREET | WHITEHALL 3-2172 | NEW YORK 5, N. Y.

PAUL STEWART & CO., INC.

UNION TRUST BUILDING — **CINCINNATI 2, OHIO**

Over 50 Years of Service

Quality··Economy··Delivery

TURBO GENERATORS

EXTRACTION CONDENSING

2500 KW 480 V. 3 ph. 60 cycle—175/185# ISP 525° F. TT Extraction 58,000#/hr. max at 5# g. (1920) Turbine being rebuilt. Will arrange for extraction at 30# g. if required. All auxiliaries.

2000 KW 550 V. 3 ph. 60 cycle—225# ISP 500° F. TT General Electric. Ingersoll-Rand surface condenser. Rebuilt in 1932 for 20# g. extraction.

CONDENSING

1000 KW (3 units) 240 V. 150# 100° Jet Cond. New approx. 1922.

1000 KW 600 V. 200# 100° SH. Surf. Cond. (A-C 1920).

1250 KW 2400 V. 200# 100° Surf. Cond. (Approx. 1924).

1500 KW 480 V. 200# 100° SH. Jet Cond. (1921).

600 KW 60/3/240 V. 150# ISP 20.5# W. R. Surf. Cond. Complete (G. E. Serial #20,000).

NON-CONDENSING

1500 KW Allis 2300 V. 175# 10# max. BP. Rebuilt for war operation. Not used.
2000 KW G. E. 480 V. 175# 10# BP. Can be renozzled for 225# 500° TT. Good for 20# without change.
1000 KW Allis 2400 V. 200# 5/10# BP (1920)
100 KW 480 V. 200# ISP 20# BP G. E. (1921)

DIRECT CURRENT

1000 KW 250 V. DC 150# Surf. Cond.
750 KW 250 V. 16#/165# (MP) Jet Cond.
150 KW (2 units) 250 V. 225# 25# g. BP Modern Design NC Unit.

BOILERS—MODERN STEAM GENERATING UNITS

350 - 400 - 450 PSIG.

2—250,000# hr. 450# Pulverized Coal Fired. Complete. Excellent.
1— 30,000# hr. B&W 425# Integral Furnace Type. Pulverized Coal Fired.
1— 40,000# hr. 350# 100° SH Combustion Eng. Integral Furnace with Type E Stoker.
Other Units 450 - 500 - 750 PSI. Specifications on request.

MID PRESSURE UNITS

600 HP 160# Sectional Header. Four of these— Pennsylvania and Indiana.
519 HP Heine Type Design. Now approved 180#. Can Ship Intact Most Midwest Points. Not Necessary to Remove or Replace Tubes. Coxe Chain Grate Stoker.
650 HP 200# 100° SH Box Header (1932). Tubes Good. Dismantled Ready to Ship.

TRANSFORMERS

LARGE POWER TRANSFORMERS

1—10,000 KVA Pittsburgh. 13,200 V. Primary to 4600 V. 60 cycle, 3 phase. Delta Connected. Complete. Cannot reconnect other Elspecs.
—5000/6667 KVA G. E. Type OAPT. OISC. Primary 24,000 Delta; four 2½% taps below. Secondary 230/460. Practically new.

FURNACE TRANSFORMERS, 3 PHASE, 60 CYCLE

1—5000 KVA 13,200 Primary to 480/240 V. 4 high and 3 low V. taps. Outdoor OIWC Wemco unit; 1944. Never used.
1—4000 KVA 22,000 V. to 260 V. 4 high voltage and 7 low voltage taps. OIWC indoor type. Mfg. Penn. Transformer Co. New; never used.
1—4000 KVA 22,000 V. to 228 V. OIWC indoor type; 1942. Used less than 2 years. Taps, 2 high V. and 11 low V.
1—4000 KVA 13,200 V. to 239/85 V. OIWC Indoor type complete except for KWH meter and integrating KWH meter.
1—4000 KVA 13,200 V. to 240 V. outdoor type—Penn. Transformer Co.
1—3000 KVA 13,200 V. to 239/85 V. OIWC indoor type Wemco. 8 years old. Complete except for KWH meters.
2—3000 KVA 13,200 V. to 240 V. OIWC Wemco.
1—2000 KVA 13,200 V. to 239/85 V. OIWC indoor type. 40 deg. continuous type. Motor operated tap changer.

1500 KW POWER PLANT COMPLETE

400 PSIG 600° F. TT — 480 volt—60# G. P. B.
Two Wemco turbo generators NON-CONDENSING 36# W. R.
One C. E. Co. type VB boiler—30,000#/hr.—C. E. Co. stoker; complete; switchgear, controls, piping, valves, fittings.

Now ready for dismantling—30 day shipment
90,000#/hr. C. E. Co. type VU, 550/600#, 750° F. TT; pulverized fired; built 1940; report excellent condition.

LIQUIDATION SALE

(MOST EQUIPMENT 3 TO 4 YEARS OLD)

DIESEL ENGINES

2—300 HP Fairbanks Morse Model 38 O.P. 6 cyl. 2 cycle 5"x6" 1200 RPM (built 1936)

2—350 H.P. Superior Diesel Ser #10501 & 10529, Type VD, MB, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 4 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1800 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

DIESEL GENERATORS

4—1200 KW, D.C., Allis Chalmers, 525 V. 750 RPM Driven 1700 HP General Motors Diesel 16-278A 750 RPM (New 1943)

1—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½ x 7" 2 cycle, 1200 RPM (new 1943)

3—60 KW, DC, 120 V driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½' x 5" 1200 RPM. New 1943

1—60 KW, DC, Generator, 250 V. driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished

MOTORS

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 60 HP, 120 V, various speeds

18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1/3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle, 1700 V, 257 RPM

28—DC 1500 HP, W'hse, 525 V, 600 RPM

HOISTS

6—Mead Morrison Co., 2 drum hoisting engines type H197, driven by 51 HP G.E. motor 230 V, DC

TURBO-GENERATORS

5—4600 KW G.E. 3 phase, 93 1/3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.

6—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.

8—200 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse 180/220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V, D.C. 1200 RPM

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V, DC, 1800 RPM, cond.

NOTE—MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

MOTOR-GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

GENERATORS
28—1200 KW DC Allis Chalmers, 525 V, 750 RPM

TURBO-BLOWERS

9—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

CONDENSERS

4—7800 Square Feet—¾" brass tubes, two pas. (new).

10—3800 Square Feet ⅝" copper-nickel tubes (new).

SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc.

TRANSFORMERS

5—50 KVA 3—10 KVA
15—25 KVA 5— 3 KVA
} from 440 V to 120 V, all single phase, 60 cycle, dry type

BOILERS

2—B&W Header type 250# pressure, 22,500# Steam hr., 4874 sq. ft. generating surface.

6—Express, Boilers, modied D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

2—Wickes Boiler 628 H.P. 3 drum. Navy Type, 250 pounds pressure.

2—Cyclotherm 3000 pounds steam per hour.

BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4600 RPM, steam 400#

2—Worth'ton 750 GPM 375# dischge., 3500 RPM, steam 240#

2—Ing. Rand 165 GPM, 575# dischge., 4650 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze motor and turbine driven.

RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel.

CENTRIFUGES

15—Sharples
15—DeLaval
} Oil purifiers and oil clarifiers capacity 100 GPH and 150 GPH, with motors and pump

HIGH PRESSURE COMPRESSORS

2—Ingersoll Rand type 40, 4 stage, 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors, 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

2—Ingersoll Rand class B, 3 stage, 3,000# press, 7½ cu. ft., driven by G. E. 3/60/440 motors, 24 HP.

DISTILLING PLANTS

2—Griscom Russell Soloshell double effect, 8000 gals. per day, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

2—Foster Wheeler 40,000 gallons per day, triple effect, low pressure.

1—Condenser Service 80 tons per day, double effect

FANS

150—from 3,000 to 16,000 CFM at 2" to 3" S.P with AC and DC motors.

FUEL OIL HEATERS

24—Griscom Russell sect. G-fin, 86 sq. ft.
1—Griscom Russell, 4 sect., 6 fin.

FEED WATER HEATERS

7—Blowers (Roots Connersville) size 16" x 18", connected to G.E. induction motor, 200 H.P., 3 phase 60 cycle, 2200 Volt, 705 RPM

2—Blowers (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM

Blower Motors also sold separately

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION

31 Nassau Street — New York 5, N. Y.

Tel.: REctor 2-1334

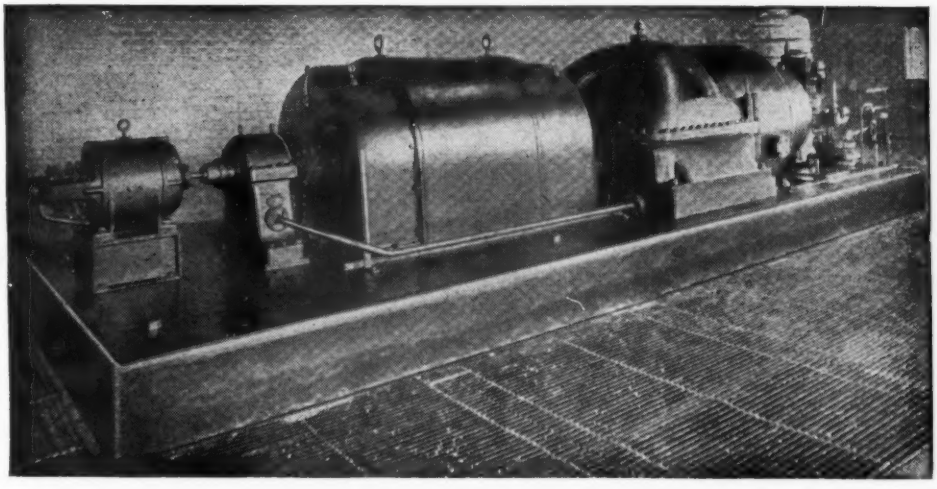
ARRANGE FOR INSPECTION

TURBO-GENERATORS

NEW & USED

IMMEDIATE DELIVERY

• SEND FOR BULLETIN 259 •



• SEND FOR BULLETIN 259 •

MODERN NO. 1 CONDITION, 1875-KVA. ELLIOTT
Inspection in Operation by Arrangement: 2300-V. 300#-PSI, 550 Deg. F. TT.

Turbo-Generators - July-August - Stock List: Ask for Buletin 259.

Partial List Only

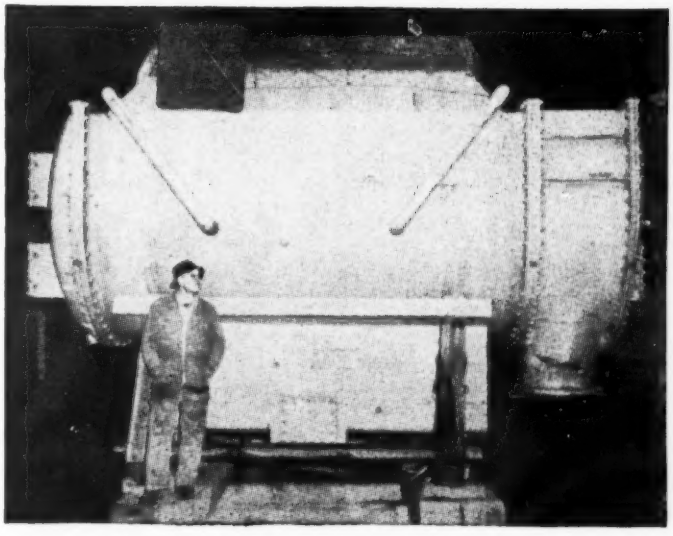
7800-KVA. G.E. 250#, 2300-V., Sur. Condenser
5000-KVA. G.E. 200#, 100-Deg., 2300-V.
3750-KVA. G.E. 200#, 2300-V., Condensing
3125-KVA. West., 200#, 2300-V., (1-GE.)
2500-KVA. G.E., Aut. Extr., 200#-psi., 25#-B., 480-V.
1865-KVA. Elliott, 350#, 550-F.TT., 2300-V.
1865-KVA. G.E., Cond., 200#, 2300-V.
1865-KVA. G.E., Aut. Extr., 200#, 30#-Back, 2300-V.
1250-KVA. Allis-C., Non-Cond. 160#, 25-Back, 2300/4000-V.
937-KVA. Terry-Allis, Non-Cond., 200#, 85#-Back, 2300-V.
937-KVA. Moore-Allis, Non-Cond., 200#, 25#-Back, 2300-V.
937 KVA. Allis-Chalmers Cond., 200#, 480-V.
625-KVA. West., Aut. Extr., 250#, 25#-Back, 480-V.
625-KVA. G.E., Non-Cond., 200#, 25#-Back, 2300-V.
500-KW., Several Good Units Available

SPECIAL

6—Brand New Westinghouse, 300 KW. Turbine-Generators, DC., 3-wire, 250-V., 450# Psi., 750° TT.

5-NEW CONDENSERS IN STOCK

3-8280 and 2-6300-sq. ft., Surface Type
Both Top Center Openings



IN STOCK NEW Steam Air Ejectors • Condensate Pumps • Circulating Water Pumps

ALSO SPECIALISTS IN: DIESEL ENGINES, BOILERS, GENERAL POWER PLANT EQUIPMENT. We OWN Outright all machines which we offer. Please use Bulletin Nos.

Correspondence Invited

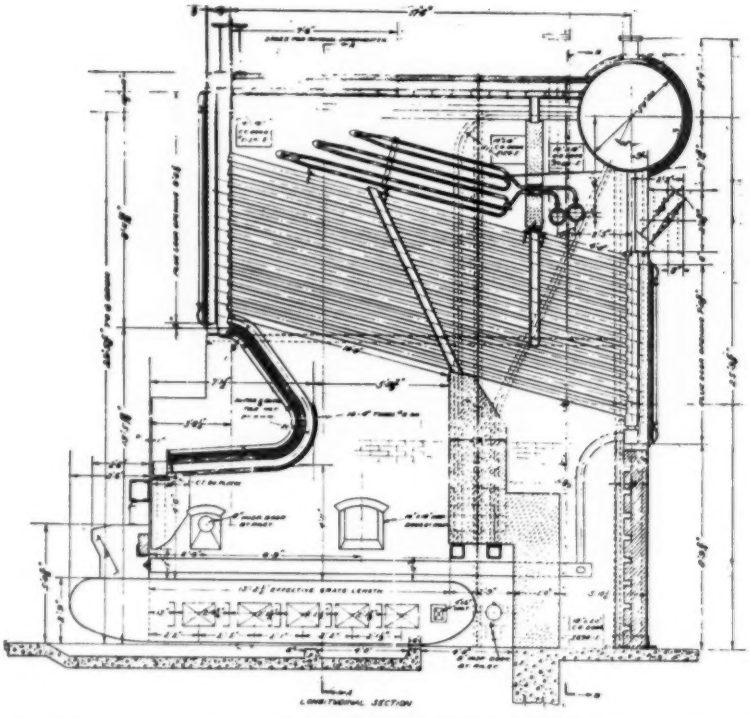
CHARLES WEAVER & COMPANY

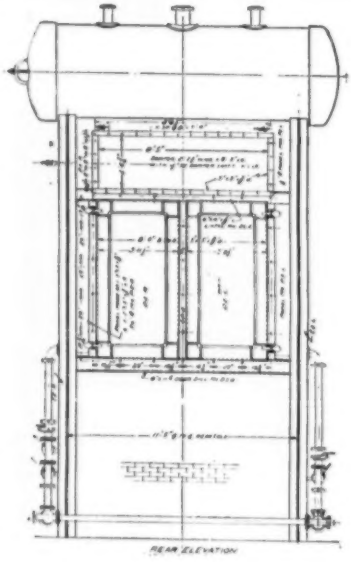
4045 Penobscot Building — ***ENGINEERS*** — **Detroit 26, Michigan**

POWER PLANT SPECIALISTS

OFFERING FOR AUGUST DELIVERY

3—Hedges, Walsh, Weidner—Sectional Header Cross Drum Boilers 400 H.P.—300# P. S. I. A.S.M.E. Standard.





Complete with Elesco Superheaters—Vulcan Soot Blowers—Forced Draft Fans (Motor Driven) and Air Preheaters—Each boiler has a Pratt Daniel Termix Stack and Induced Draft fan (Motor Driven). The usual trim included, of course.

HOWE BROTHERS

342 MADISON AVENUE, NEW YORK 17, N. Y.

Tele. Nos. Mur. 2-8562-8563-8564

REBUILT POWER EQUIPMENT—READY TO SHIP

D.C. MOTORS

230 Volt

No.	H.P.	Make	RPM	Type
20	½	West.	1750	CDH
12	¾	West.	1750	CD
18	¾	Wagner	1725	
15	¾	West.	1140	CD
47	1	West.	1725	CD
30	1	West.	1140	CD
6	1	West.	865	CD
18	1½	West.	1725	CD
17	1½	West.	1180	CD
14	1½	West.	900	CD
23	2	West.	1725	CD
26	2	West.	1150	CD
20	2	West.	850	SK-23
20	3	West.	1725	CD
25	3	West.	1150	SK-23
15	3½	West.	850	SK-30
20	5	West.	1800	SK-20
44	5	West.	1150	SK-30
20	5	West.	850	SK-43
15	7½	West.	1750	SK-33
16	7½	West.	1150	SK-43
10	7½	West.	975	
6	7½	Cr. Wh.	875	CCM
8	7½	West.	850	SK-60
4	10	West.	1750	SK-43
10	10	West.	1150	SK-60 & 63
15	10	West.	850	SK-70
14	15	West.	1150	SK-83
3	15	Reliance	1150	66 TF
2	15	West.	900	SK
1	20	G.E.	3500	CD
4	20	West.	1750	SK-83
2	20	West.	1150	SK-93
3	20	West.	900	SK-100L
5	20	West.	975	
5	25	West.	1150	SK-103
2	25	West.	850	SK-120
1	25	West.	600	SK-130
3	55	West.	650	SK-121

TURBO GENERATOR SET

750 kw. G.E. Curtis Steam Non-Condensing 220/440 or 2300 v. 3 ph. 60 cy. A.C. complete.

M.G. SETS

250 V. D.C.

(Motors 220/440 or 2200 V. 3 ph. 60 cy.)

No.	KW	Make	Speed
2	15	West.	1150
1	20	West.	900
2	40	West.	850
5	50	West.	1200
2	75	Star	1200
2	75	G.E.	600
4	100	Star	1200
1	150	G.E.	1200
1	150	Cr. Wh.	720
1	200	Elliott	1200
1	200	Cr. Wh.	720

Can furnish M.G. Sets at 125 V.D.C. from 5 kw. up to 100 kw. for immediate shipment from stock.

D.C. GENERATORS

250 V. D.C.

No.	KW	Make	Speed
10	10	West.	1150
11	15	West.	1400
3	15	West.	1150
2	20	West.	1400
3	20	West.	1150
5	25	West.	1400
4	25	West.	1150
3	40	West.	850
5	50	Louis Allis	1150
4	75	Star	1150
5	100	Star	1200
3	125	Star	1150
1	175	Cr. Wh.	720
1	200	Cr. Wh.	720
1	200	Elliott	1200
1	300	Sturtevant	425
2	300	West.	225

DYNAMOMETER

"Hi-Eff." hydraulic size 35#, model 58S, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS

3—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP, 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

VARIABLE SPEED MOTORS

230 Volt D.C.

No.	H.P.	Make	RPM	Type
1	1	L.A.	640/1800	BW
1	1½	West.	740/2200	SK
2	2	Reliance	500/1000	
2	1½	West.	550/2200	CD
2	2	West.	500/2000	SK
1	2	West.	700/2100	SK
20	2	West.	850/1750	SK
3	2	G.E.	415/830	RLC
2	2½	G.E.	500/1000	RLC
7	2¾	West.	900/1800	SK
25	3	West.	1150/1800	SK
3	3	West.	650/1950	SK
5	3	Roth	500/1000	Tot. Enc.
15	3½	West.	850/1800	SK
4	3½	West.	450/1800	SK
2	3½	West.	660/2000	SK-30
1	4	West.	500/1000	SK
25	5	West.	850/1750	SK
50	5	West.	1150/1750	SK
1	5	West.	550/1725	SA
5	5	West.	400/1600	SK-70
1	5½	West.	500/1500	SK-60
10	7½	West.	975/1800	SK
8	7½	West.	850/1750	SK
1	7½	Reliance	600/1200	
1	7½	G.E.	700/1400	CE
1	7½	West.	500/1500	SK-60
1	7½	Reliance	450/1800	78T
15	10	West.	850/1750	SK
14	15	West.	1150/1750	SK
3	15	West.	900/1800	SK
1	15	West.	750/1500	SK-113
3	20	West.	900/1800	SK
5	25	West.	1150/1750	SK
2	25	West.	850/1750	SK
1	25	West.	600/1200	SK-130
1	25	West.	325/975	
1	40	Roth	385/1200	
3	55	West.	650/1300	
1	163	G.E.	545/1090	CD
1	300	G.E.	400/600	DMC
2	400	West.	180/250	NA

COMPRESSORS

2—315 cu. ft. 100 lb. pres. Ingersoll-Rand, Models 315 and 315A portable Air Compressors with 105 HP Waukesha Oil Engines, complete with accessories.

1—630 cu. ft. 100 lbs. pressure Burry Horiz. Compressor.

INDUSTRIAL TRUCKS

5—Automobile type LO-5 Low Lift Electric Trucks capacity 5 ton platform type.

5—New 4 ton Yale & Towne Model Y8W Multi-stroke Hand Lift Platform.

CONVEYOR SYSTEM

Palmer Bee—open chain & trays complete with 5 HP. A.C. motor, Reeves drive, Worm Gear Reducer 90.6 to 1, Unit mt'd on I Beam, platform 42x96" 1928' of 4" open link chain, 727 tray hooks & trolley, curves, rollers etc.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph. 60 cy. 150 A. enclosed type.

PROPELLER FANS

11—New American Blower mtd. in cylindrical casting with flangel ends 24" opening one end, 30" other end, 16½ deep, blades 11" long direct driven 1 HP., 220/440 v. 3 ph. 60 cy. 1140 rpm., Motors.

TESTS STANDS

3—Dennison Eng. Co. portable, hydr. model PHTS-2, 7 GPM constant volume dir. con. 7½ hp. A.C. motors, 3000 lbs. pres. capacity.

DEGREASER

Blakeslee, Liquid fully conveyorized, immersion loading and unloading at opposite ends, 13' long 5'3" wide, 10'8" high with 1¾ HP. A.C. motor. Conveyor speed 9 rpm., dual vapor control, gage glasses, thermometers, necessary piping and fittings, double strand chain conveyor with cross rods, 25"x20"x3" deep baskets, ¾" Sacro TR-40-3 Water Control, 1½" Sacro SF. 11 Vapor control, storage Tanks, #3 Still, Trans. pump and motors.

TRANSFORMERS

1 ph. 60 cy.

cu.	kva	Voltage	Make
3	110	6600, 6000/1150, 2300	G.E.
3	50	11000/2200	Westinghouse

DUST COLLECTING UNITS

5—NEW portable, self contained ¼ HP. A.C. Motors, overall Dim 25"x14½"x23 single inlet, single outlet Fried Air Kool Co.

WINCHES

240—Winch assembly portable engine hoists, swivel hook, 4¾" l. with 1½" opening and 30' of ¼" cable. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

PRESSES

2—Bliss hydro Dynamic marking vertical with 5 HP. A.C. motors 30 ton capacity.

INDUSTRIAL VACUUM CLEANERS

5—Sturtevant type F with ¾ HP. A.C. Motors.

LIFTING MAGNETS

3—54" E.C. & M. Co. rectangular, model #3, type F 230 v. D.C.

RADIAL DRILLS

Chic. Pneumatic Tool Co. portable or stat. swing arm length 72" reach.

Chic. Pneumatic Tool Co. portable or stat. swing arm length 31" capacity.

½" Jacob Chuck.

WELDING AND PLATING SETS

1—Chandeysson 50 KW., 40 V. D.C. 600 rpm., 75 HP. Synchronous Motor 220/440 v. 3 ph. 60 cy., with exciter 100% P.F.

1—Thompson Shell Welder including West. control, 6 electronic tubes, ½ HP. A.C. Motor.

1—Federal special seam welder 200 kva., 220/440 v. 60 cy. 5 DC max. sec. amps. 34000 at ¼ x 33 throat, sec. volts 5.1 10.2 max. air pres. 90 min. water inlet pres. 65# 70 deg. F. max.

1—Federal seam welder 150 kva., 220/440 v. 60 cy., .5 DC max. sec. amps. X30,000 at 4 BY-28 throat sec. volts 4-8 max. air pres. 90 deg. min. water inlet pres. 50 lbs. at 70 deg. F. 1 HP. AC. Motor.

CONDENSER OR SYN. MOTOR

500 HP. Elec. Machinery Co. SYN Motor 80% P.F. 120 rpm., 4000/2200/440 or 220 v. with exciter.

STORAGE BATTERY LOCOMOTIVES

2—4 ton Goodman 30" ga. with Edison 63-G 18 batteries with 2 motors 11 HP., 80 v. double reduction gear, 3½ mph. 2000# draw bar pull. 1—spare set of batteries and bat. box with each.

POWER PLANTS

5—NEW 1½ kw. Homelite portable 115 v. 1 ph. 60 cy. 1 cyl. air cooled 2 cycle gas or gasoline.

1—5 kw. Engberg Steam Engine 220 V.D.C.

2—5 kw. Portable Master Elec. 110/220 v. 1 ph. 60 cy. 4 cyl. Wis gas or gasoline engines 80% P.F. pneu. tires.

1—7½ kw. port. Master 4 cyl gas or gasoline 120 v. 1 ph. 60 cy. with pneu. tires and tongue.

2—10 kw. 120/v. Star Generators dir. con to Hercules DIESEL 250.

1—25 kw. 120/208 v. 3 ph. 60 cy. 80% P.F. West. Gen. dir. con. to Le Roi Gasoline Engine

2—30 kw. 125/v. G.E. Generators dir. con Buda DIESEL

1—35 kva. Ridgway 220/3/60 dir. Con. Ridgway STEAM engine.

1—125 kva. West. 240/480 v. 3 ph. 60 cy. West. dir. con. Erie Ball STEAM Engine.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	5013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

MOTORS
3 phase, 60 cycle—220/440 volts

H.P.	Make	Type	RPM
5	American	Splash Proof BB.	1200
5	G.E.	Tri Clad	1750
5	G.E.	I Form K	680
7½	Amer. El.	Splash Proof BB.	1200
10	Amer. El.	Vertical BB.	1200
10	G.E.	KT956	1200
10	G.E.	KT752	1200
15	G.E.	KT312	855
15	West.	CS	1155
20	West.	New BB.	1200
20	G.E.	Tri Clad BB.	3600
20	West.	New CS365	1800
25	West.	New CS444	900
25	West.	CS	1200
30	West.	New CS445	900
30	West.	CS	1200
40	Cr. Wh.		685
40	Lincoln	1M	720
40	G.E.	KT323	1740
50	Al.-Ch.		1800

H.P.	Make	Type	RPM	Ser. No.
50	Al. Ch.		1800	3K28825
60	G.E.	I	1800	292596
60	Whse. 2200V.	CCL	1200	854121
75	Westhgse.	CS	1800	2134671
100	Westghse.	CCL	1800	1043213
125	Westghse.	CCL	1800	765231
125	Westghse.	CS	1200	2318625
150	Westghse.	CS	1800	2429726
150	G.E.	PK	1200	
250	G.E.	I-K	600	2246834
300	G.E.	I-K	720	2357743
400	G.E.	I-K	900	2347845

FREQUENCY CHANGERS
All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle if desired.

25 CYCLE TRANSFORMERS
3—500 KVA Pennsylvania Transformers 25 Cycle, 1 Phase, 2300 Volts Primary 230/460 Volts Secondary.

60 CYCLE TRANSFORMERS
1—3000 KVA Kuhlman Transformer 60 Cycle, 3 Phase, 14,160 Volts Primary 240 Volts Secondary.

25 CYCLE GEARED MOTORS
3—10 H.P. Westghse., Frame 364 Encl. 1500/378 RPM.
1—15 H.P. Master, Frame 405 Encl., 1450/416 RPM. Exp. Proof.

D.C. CIRCUIT BREAKERS
4—800 Amp. ITE air breakers 2 pole 250 volts complete with overload trips 600/1200 Amp.—mounted on slate panels.

MOTOR GENERATOR SETS
2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440/60/720 RPM. with panel board.

SPECIAL
1—150 HP. Fairbanks Morse Ball Bearing Motor. 3/60/440/1800 RPM.
1—75 HP. Fynn-Weischel (Wagner) Synchronous Motor Serial #345781, 3 Phase 60 Cycle 440 Volts, 1200 RPM.
1—75 HP. Fynn Weischel Synchronous Motor 3 Phase 60 Cycle 440 Volts 1200 RPM. with starting control.
1—150 HP. Fairbanks Morse Ball Bearing motor 3/60/440/1800 RPM.
1—300 HP. Gen. Elect. Synchronous Motor. Type ATI. 3/60/440/1200 RPM., .8 PF. with direct connected exciter and starting equipment.
1—300 HP. Gen. Elect. Squirrel Cage Motor. Type I15—3/60/440 1200 RPM. with starting equipment.

NEW MOTORS
100—New motors from ½ HP. to 30 HP. in stock, 60 Cycle single and 3 Phase.

ROTARY CONVERTER
1—2000 KW. Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

AIR COMPRESSORS
2—5000 CFM Worthington low pressure 45 lb. Compressors with 500 H.P. Gen. Elect. Motors. 3 phase 25 cycle 2300 volts.—Complete.
2—1000 CFM 100 lb. Compressers Driven by 200 HP. Motors.
1—1700 CFM Worthington 2 Stage 100 lb. with motor.

2—5000 CFM. Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

2300 VOLT PRIMARY CONTACTORS
2—150 H.P. Westinghouse AC magnetic controllers 3/60/2300 V.
1—225 H.P. Square D magnetic controller 3/60/2300 V.
2—200 Amp. Schweitzer-Conrad Load Breaks—3 Pole Fused. 3/60/2300 V.

ERIE ELECTRIC CO., INC.
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

Write—Wire—Phone
us if you don't see the item you need. This listing is only a part of our large stock.

M-G SETS
Others available—special units built to order.

200 KW Gen. Elec. MPC gen. DC 125 V. coupled to 300 HP G.E. synch. motor 3/60/440 V. 900 RPM.
150—KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM.
75 KW Cr. Wheeler 65 H gen. DC 125 V. coupled to 100 KVA synch. motor 3/60/440 V.
75 KW G.E. DLC gen. DC 125 V. coupled to 115 HP sq. cage motor 3/60/220/440 V. 1200 RPM.
37½ KVA. Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM. 3 brg.
35 KW G.E. CD gen. DC 48 V. 750 amp. coupled to 60 HP motor 3/60/220/440 V. 1200 RPM.
2—10 KW Whse. like new, DC 250 V. output, AC motor 3/60/220/440 V.

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
250	Whse.	ped.	230	275/690
100/150	G.E. dynamon.	TLC	250	1000/3500
75	Whse.	S136	125	475
75	Gen. Elec.	BRC	115	1150
65	G.E. Northern	C	230	375/750
60	Diehl dynamon.	R10	250	500/2000
60	G.E. b.b	CDM103	230	1750
15	Louis-Allis	ONW		575/1725
50	G.E. Sprague	IC	250	700
50	Cr. Wheeler	50H	230	700
40	Roth	S	115	850
35/50	Gen. Elec.	CD123	230	575/1150
25	Roth	RS	230	1750
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
25	G.E. b.b. New	CD93	115	1150
20	G.E. b.b. New(2)	CD83	115	1750
20	Reliance	T	230	850
20	Imperial Int. dty.	D37	230	1200
20	Gen. Elec.	IC	230	575
20	Gen. Elec.	DLC	230	500/1500

SLIP RING MOTORS
3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfg.	Type	Speed
1	400	Gen. Elec. 3 brg.	I-P	450
1	200	Gen. Elec.	I-M	1200
1	200	Gen. Elec.	I-M	1800
1	200	G.E. 2200 v.	I-M	360
1	200	Whse. 3 brg.	HF	600
1	100	Whse.	CW761C	1800
1	75	Ideal	A350	720
1	60	Howell	SR	1800
1	60	Ideal 2200/4000 v.	A	1800
2	40	Allis Ch.	ANY	450
2	37	G.E. int. duty	ITC	1200
1	37	G.E. int. duty	ITC	600
1	35	Lancashire b.b.	late	1800
1	30	Gen. Elec.	MT346	600
2	30	Gen. Elec.	OMT336	1200
1	25	G.E. int. duty	ITC	1200
1	25	Gen. Elec.	I-M	600
1	25	Triumph	SR	1200
1	15	Gen. Elec.	I-M	900
1	300	Gen. Elec. IM	IM	1800
1	15	Watson	KHV	720
4	10	Century New b.b.	SRT326	1200

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
225	KVA Gen. Elec.	ATI	220/440	900
150	Whse.		220/440	600
125	Whse.	G	2200	900
100	KVA Cr. Wheeler		220/440	900
75	Elec. Machy.	BRKT	550	900
60	Elec. Machy.	BRKT	220/440	1200

Special—50 H.P. Gearhead
Motors—Howell bb 2 speed 1800/900 RPM 3/60/440 V. attached to D. O. James spur gear reducer, output 158/79 RPM, like new.

* * * *

Also many speed reducers and gear motors in stock up to 15 H.P.

SQUIRREL CAGE MOTORS
3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfg.	Type	Speed
1	400	G.E. 2200 v.	I-K	1800
1	175	G.E. 2200 v.	I-K	600
1	125	Whse. 2200 v.	CS 505	3600
1	125	Northwn.	H	1800
1	75	Gen. Elec.	I-K	720
1	60	Ideal	A	1200
1	75	Gen. Elec.	KT-329Y	3540
1	50	Whse-TEFC	CS-504	1200
2	50	Whse. 2200 v. vert.	CS	900
1	40	Gen. Elec.	I-K	900
1	40	Allis Ch. 3 spd.	ARX	900/600/450
1	40	Whse.	CCL	720
1	40	Gen. Elec.	I-K	1200
2	35	Gen. Elec.	I-K	720
2	30	Howell b.b. 4 spd.	SC	1800
1	30	F. Morse	BH	600
2	25	Gen. Elec.	I-K	720
1	25	Gen. Elec.	I-K	600
2	20	Gen. Elec.	I-K	720
1	20	F. Morse	BH	900
2	20	Whse. New b.b.	CS 364	1800
1	60	Gen. Elec.	KT 505	1200
2	20	Century b.b. 4 spd.	SC 504	1800
2	20	Whse. New TEFC	CS 364	1800

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rf.	750
150	Whse.	HF sl. rg.	500
150	Whse.	C sq. cg.	500
100	Whse.	CCL sq. cg.	500
50	Allis Ch.	ANY sl. rg.	1500

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1	MPC	125/170	1150
75	Whse.	S	125	600
50	Cr. Wheeler	CCD	250	850
30	Lincoln b.b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
20	Allis Ch. (2)		125	475

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
300	Gen. Elec.	ATB	240/480	600
250	Gen. Elec.	ATB	240/480	600
225	Gen. Elec.	ATB	240/480	900
165	Elec. Machy.	BRKT	240/480	900
150	Allis Ch. 25 cycle		240/480	500
150	Allis Ch.	B	2300	900

ARTHUR WAGNER COMPANY
1436-38 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 7409

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

2—6250 KW Gen. Elec. Cond. 25 Cycle
1—5000 KVA General Electric Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
2—3125 KVA General Electric Extrac.
2—1250 KVA General Electric Cond.
2—1250 KVA Elliott Cond.
1— 225 KVA General Electric Non-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—450 KVA Ames Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Harrisburg 4-valve
1—125 KVA Ames Uniflow

D.C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—275 KW Ames Uniflow, 250 V.

DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V., 60 cy. gen.
1— 750 HP Cooper Bessemer, 460 V., 60 cy. gen.
4— 720 HP Amer. Loco., 240 V. DC
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

1—1409 HP B. & W., 650-lb. Stokers
2— 748 HP EdgeMoor 250-lb. Stokers
2— 560 HP Erie City 460 lb.
1— 519 HP Titusville 200-lb. Stoker
5— 492 HP Heine, 180-lb. Stokers
2— 469 HP B. & W. 425-lb. Pulverizer

SYNCHRONOUS MOTORS

4—6000 HP G.E. 60 cy. 2300 V. 90 RPM
4— 400 HP West. 2300 V. 600 RPM
1— 300 HP G. E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 2300 V. 900 RPM
1— 100 HP G.E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

1—1000 HP West. S/R, 2200 V. 360 RPM
3— 150 HP Burke S/C 440 V. 1800 RPM
3— 150 HP C. W. S/C, 440 V. 1200 RPM
1— 150 HP G.E. S/C, 440 V. 600 RPM
1— 150 HP G. E. S/C, 2300 V. 1800 RPM
2— 120 HP G. E. S/C 220 V. 3600 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1— 500 KW Cr. Wh. 600 V. DC, 60 cy.
1— 400 KW Cr. Wh. 275 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC, 25 cy.
2— 300 KW Allis Chal. 275 V. DC, 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC, 25 cy.
2— 225 KW Gen. Elec. 115 V. DC, 60 cy.
2— 125 KW Westinghouse 115 V. DC, 60 cy.
1— 75 KW Westinghouse 125 V. DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.

FREQUENCY CHANGERS

1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1200 KVA G. E. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

2— 2000 KVA West. 69/34.5-4.8/2.4 KV
1— 3500 KVA West. 33000/13800-3 ph.
4— 333 KVA Al.C. 25410/44000-13200/23000Y V.
1—10000 KVA West. 26400-4580 V.-3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
1—3750/5000 KVA West. 22000/460 V.-3 ph.
1— 3000 KVA West. 13800-2400 V.-3 ph.
1— 3000 KVA Kuhlman 13800-240 V.-3 ph.
2—10000 KVA Pitts. 13200-4600 V.-3 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
2— 1500 KVA Al. Ch. 2400-480 V.-Chlorextol
3— 250 KVA Moloney 2300-240/480
3— 15 KVA West. 440-220/110 V.

OIL CIRCUIT BREAKERS

2— 400 A. 25 KV G. E. FKO136 Outdoor
2—1000 A. 23 KV Kelman CB76 Outdoor
6— 600 A. 15 KV G. E. FK255 Indoor
4— 600 A. 15 KV G. E. FHKO139-24BS Outdoor
1— 600 A. 15 KV G. E. FKO37 Pole Type
2— 400 A. 15 KV G. E. FHKO136 Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

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SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM, 6 PH. 60 CY, SWITCHGEAR AND TRANSFORMERS.

300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM. 6 PH. 60 CY. SWITCHGEAR AND TRANSFORMERS.

MOTOR GENERATORS

500 KW G.E. SYN. 600 V. 2200/4000 A.C. 1200 RPM, 3 PH, 60 CY. COMPLETE MANUAL SWITCHGEAR.

400 KW G.E. SYN. 250 V. 2200/4000 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

300 KW RIDGWAY SYN. 250 V. 2200 A.C. 1200 RPM, 3 PH, 60 CY. COMPLETE MANUAL SWITCHGEAR.

150 KW WEST. SYN. 250 V. 2300 A.C. 900 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK COMPANY
Incorporated
502 Grant Building, Pittsburgh, Pa.

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

3— 3,000 KW 600 V Cond.
1— 2000 KW 600 V Cond.
1— 2000 KW 480 V N.C.
2— 1500 KW 2300 V Cond.
1— 1250 KW 2300 V. Cond.
1— 1000 KW 440 V. Extrac.
1— 1000 KW 2300 V Cond.
1— 750 KW 240 V Extrac.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
1— 250 KW 240 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC, N.C.

ENGINE GENERATORS

2—600 KW. 2300 V. Uniflow
1—168 KW. 600 V.
1—280 KW. 480 V.
1—250 KW. 480 V.
1—150 KW. 480 V.
1—125 KW. 125/250 V.D.C. Uniflow

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS

1—90,000# 550 PSI
1—50,000# 250 PSI
1—30,000# 425 PSI
2—507 HP 160#
1—500 HP 400#
1—460 HP 250#
1—200 HP 160# HRT
1—150 HP 150# HRT
1— 75 HP 150# NEW

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1—5000 CFM 10# G. Rotary Type Driven by 440V. Syn. Motor.

TRANSFORMERS

3—200 KVA 600/220/110

MOTOR GENERATORS

1—100 KW 550/125V

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The Buyer Must Be Satisfied—Always

NEW—REBUILT & GUARANTEED MOTORS — M-G SETS — TRANSFORMERS

NEW MOTORS

3 ph. 60 cy.

Qn.	H.P.	Make	Volts	Speed	Type
60	1	Peerless B. Brg.	220/440	1800	P18S
5	2	West. T. E. F. C. B. B.	220/440	1800	CSP-224
3	2	Dayton B. Brg.	220/440	1800	224
3	3	Dayton B. Brg.	220/440	1800	225
1	3	West.	220/440	1800	CSP-225
1	3	West.	220/440	1200	CS-254
1	3	Wagner	220/440	1200	RPI-254
2	3	Brown & Brock.	220/440	1800	225
10	5	West. B. Brg.	220/440	1800	CSP-254
1	5	West.	220/440	1200	CSP-254
1	15	G.E. B. Brg.	220/440	1800	K-326

1 ph. 60 cy.

2	1½	G.E. Exp. Pro.	115/230	1800	SCR-224
11	¾	B-Line	115/230	1800	RS-720-R

TRANSFORMERS

Qn.	KVA	Cycle	Voltage	Make	Type
1	2	60	2300/115/230	G.E.	H
1	2½	60	2300/115/230	G.E.	H
1	3	60	2300/115/230	G.E.	H
1	3	60	2300/110/220	Pitts.	
1	5	25	440/110/220	Pitts.	
1	5	25	2220/220/110	West.	S
2	7½	60	2200/220/110	West.	
1	10	25	2300/230/115	G.E.	H
5	15	60	2300/110/220	Pitts.	
1	15	60	2300/115/230	G.E.	
2	25	25	2300/115/230	Pitts.	
2	50	60	2200/110/230	Pitts.	
1	50	25	2300/230/460	Pitts.	
3	75	60	2200/120/240	G.E.	H-K
1	10,000	60	33,200/4,600	Pitts.	

A. C. MOTORS

3 ph. 60 cycle

Qn.	H.P.	Make	Type	Volts	Speed
10	½	G.E.	KT	220/440	3600
5	¾	G.E.	KT	220/440	1800
4	2	G.E.	KT	220/440	1200
1	2	G.E.	Exp. Proof	220/440	1800
1	2	West.	Vertical	220/440	1200
2	3	G.E.	KT	220/440	900
2	3	West.	CSP-254	220/440	1800
1	7½	G.E.	KT-180	220/440	1800
2	10	W. B. Brg.	CS-326	220/440	1200
4	10	Al. Ch.	AN	220/440	1200
2	10	West.	CS	220/440	1200
1	15	W. B. Brg.	365	220/440	1200
5	15	Al. Ch.	AN	220/440	1200
1	15	G.E. B. B.	KT	220/440	720
1	20	G.E.	I-K	220/440	600
2	20	Wagner	BP	220/440	1300
1	25	Gen. Elec.	KT	220/440	900
4	25	Al. Ch.	AN	220/440	1200
1	25	Cr. Wh.	Sl. Rg.	220/440	1200
1	25	Lincoln		220/440	1200
2	30	W. E.	KT	220/440	900
3	30	Al. Ch.	AN	220/440	1200
2	30	West.	CS	220/440	720
3	35	G.E.	I-K	220/440	900
1	35	Al. Ch.	AN	220/440	1200
2	40	Gen. Elec.	IK	220/440	1200
1	50	Gen. Elec.	KT-346	220/440	900
2	50	Gen. Elec.	K7337	220/440	1800
3	50	West.	CS	220/440	1800
2	60	Allis Chal.		220/440	1800
1	60	Rob. Meyers	K-209	220/440	1200

A. C. MOTORS

3 ph.. 25 cycle

Qn.	H.P.	Make	Type	Volts	Speed
18	2	G.E.	KT-731	220/440	750
5	5	Howell	SC-232	220/440	750
14	5	G.E.	KT	220/440	750
5	5	West.	CCL	220/440	750
1	7½	West.	CS	220/440	750
4	7½	G.E. Sl. Rg.	I-M	220/440	750
2	10	West.	CS	220/440	500
1	10	G.E.	I-M	220/440	750
1	10	G.E.	KT	220/440	750
1	15	Howell B.B.	SCR	220/440	500
1	15	G.E.	I	220/440	750
2	15	Gen. Elec.	IK	220/440	750
2	20	Gen. Elec.	IK	220/440	750
3	20	G.E.	KT	220/440	750
1	20	W. Sl. Rg.	CW	220/440	750
2	25	G.E.	I-K	220/440	750
1	25	W. Sl. Rg.	CW	220/440	750
1	25	Burke S. R.	WEV	220/440	750
2	25	Gen. Elec.	KT-337	220/440	750
2	25	Westinghouse	CS	220/440	750
2	30	Allis Chal.		220/440	750
1	60	Gen. Elec.	IK	220/440	300
1	100	G.E.	I-K	220/440	750
1	200	West.	CS	220/440	750
1	200	G.E.	I-K	220/440	750
1	3	G.E.	KT-160	220/440	1500
7	5	G.E.	KT	220/440	1500
2	5	G.E. Sl. Rg.	MT-181	220/440	1500
7	5	West.	CS	220/440	1500
1	7½	G.E.	I-K	220/440	1500
1	15	West.	CS	220/440	1500
1	25	Wagner	BP	220/440	1500
1	250	G.E.	I	220/440	1500

STEAM POWERED GENERATOR

(1) Hoover Owen Renschler 750-H.P., Uniflow Steam Engine direct connected to 500 KVA Crocker Wheeler Generator, 250 volts, 150 RPM. Complete with accessories and control panels.

We buy for cash. Send us your list of surplus equipment.

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PHONE GR 2715

MOTORS—M. G. SETS—CONTROL

In Stock—Immediate Shipment—Rebuilt & Guaranteed

CRANE & MILL MOTORS

230-V. D.C.

Qu.	h.p.	Make	Type	R.P.M.
3	5	G.E.	MD-101	825
2	6/7½	Whse.	MC-20	725/625
1	6	G.E.	CO-1805	1150
1	*9	G.E.	MD-102	975
1	10	G.E.	CO-2504	700
1	14/19	Cr. Wh.	B. W.	675/560
1	19	Cr. Wh.	S. W. S.-15	560
1	21	G.E.	C. O.-2506	540
1	25	G.E.	COM-1828	850
1	30/42	Cr. Wh.	D. W.	620/520
1	30/45	G.E.	MD-104½	625/500
1	33	Cr. Wh.	SWS-25	500
2	35	G.E.	CO-2506	650
1	*40/50	G.E.	MD-105	550/475
1	50	G.E.	CO-1829	750
2	*50	G.E.	COM-1830	525
1	50	G.E.	CO-1830	525
1	54/80	Cr. Wh.	F. W.	575/480
2	65	G.E.	CO-1830	700
5	65/85	G.E.	CO-1811	600/550
1	70/90	Whse.	MCA-70	450
1	75/85	G.E.	MD-106	500/460
1	85/110	G.E.	MD-107	500/450
2	100	G.E.	CO-1812	600
1	*100/140	G.E.	MD-108	500/430
1	100/140	G.E.	MD-108	500/430
1		Whse.	MTA#2	

All above series except * compound wound.

MOTOR GENERATOR SETS

1—10 KW, 250-VDC., 1800-RPM., Sq. Cg. Motor, 220/3/60-Cy.

1—175 KW., 250-VDC., Comp. Interpole, 1200-RPM., 260-HP. G.E. syn. motor, 4100/2200/3/60-Cy., complete with A.C. and D.C. panels and starting equipment.

1—3-Unit Set, (2) 70 KW, 40-VDC. Generators, (1) 210-HP. Westghse. Syn. Motor, 440/3/60-Cy., complete with A.C. and D.C. panels and control equipment.

ADJUSTABLE SPEED MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1	¾	G.E.	B.D.-225	600/1800
1	2	G.E.	R.F.-7	500/2000
1	2	G.E.	C.D.-55	700/2100
1	3½	Whse.	S.K.-30	660/2000
1	3	Rel.	T-14	1200/3600
1	5	G.E.	R.F.-9	450/1350
1	5	Whse.	SK-33	1150/1650
1	6	G.E.	R.F.-9	450/1350
1	7½	G.E.	R.F.-10	450/1350
1	7½	G.E.	R.F.-10	450/1800
1	7½	Rel.	T-78	500/1500
1	7½	G.E.	C.D.-75	600/1800
1	7½	Whse.	SK-70	600/1800
1	7½	Whse.	SK-60-L	650/1300
1	8	Whse.	SK-100-L	300/1200
1	8½	G.E.	R.F.-9	600/1800
2	9	G.E.	R.F.-10	400/1600
1	10	Whse.	S.K.	250/1000
1	10	G.E.	R.F.-12	300/1200
3	10	Whse.	SK-90	400/1600
1	10/15	Al. Ch.	E.B.-100	575/1725
3	15	G.E.	R.F.-11	400/1600
1	15	El. Dy.	10-S	450/1350
3	15	G.E.	RF-10	550/1650
1	15	El. Dy.	5-S	600/1200
1	19	Whse.	SK-100-L	600/1200
1	20	G.E.	RF-12	400/1600
1	25	G.E.	C.D.-128	200/800
1	25	G.E.	R.F.-13	400/1200
1	25	Rel.	T-262	500/1500
1	25	G.E.	RF-11	500/1500
2	27½	El. Dy.		450/1350
1	30	G.E.	C.D.M-105	875/1750
1	32½	Whse.	SK-150	400/1200
1	35	G.E.	RF-14	250/1000
1	35/50	Whse.	SK-160	500/750
1	50	Whse.	SK	250/1000
1	50/65	El. Dy.	30-S	300/1200
1	60	Whse.	SK-131	500/1500
1	100	Rel.	T-1050	400/1200
1	150/185	El. Dy.	75-S	250/500
1	200/250	Rel.	2600-T	400/800

WE CAN SUPPLY WITH THE ABOVE ADJUSTABLE & CONSTANT SPEED MOTORS—Manual—Semi magnetic and manual and fully magnetic AUTOMATIC CONTROL "ENGINEERED TO YOUR SPECIFICATIONS."

SQUIRREL CAGE MOTORS

3-Phase 60-Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	20	G.E.	I-K	220	565
1	25	G.E.	I-K	220	600
1	25	Whse.	CS-567	220	1160
1	25	Cent.	AS-30	550	1155
1	25	Al. Ch.		550	1740
1	25	Burke		550	1800
6	50	Whse.	CS	220	900
1	75	G.E.	I-K	220	1800
3	75	Cr. Wh.	Q-230	440	890
1	150	G.E.	I-K	440	900
1	200	G.E.	KT-357	4600	1750
1	200	G.E.	KT-357	2200	1750

3—20-HP, Westinghouse CS-364Y gear motors, 220/440-V., 3-Ph., 60-Cy., Class I, TE, BB, fan-cooled, 68-RPM.

SLIP RING MOTORS CONSTANT DUTY

3-Phase 60-Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M
1	10	G.E.	I-M	220	1120
1	10	G.E.	I-M	550	1150
1	10	Whse.	CW	440	900
1	20	G.E.	MT-326	220	900
2	25	G.E.	MT-332	2200	850
2	25	G.E.	MT-332	550	900
1	30	Al. Ch.	ANY	440	900
1	40	Al. Ch.	ANY	2200	435
1	40	Al. Ch.	ANY	550	450
1	40	Whse.	CW	2200	1800
3	40	G.E.	I-M	600	1170
1	50	Whse.	CW	2200	1800
1	125	Wag.	BR	2200	1160
1	200	G.E.	I-M	2200	450
1	250	G.E.	MT	2200	900
1	300	Whse.	CW-3	2200	885
1	300	Al. Ch.	ANY	2200	514
1	350	Al. Ch.	ANY	2200	514
1	400	Whse.	CW-1108	2200	514
1	400	G.E.	MT-412	440	600
1	500	Al. Ch.	ANY	440	600

(Manual or Magnetic Control for starting duty, or reversing or varying speed, can be supplied ENGINEERED TO YOUR SPECIFICATIONS)

T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

Guaranteed Equipment...For Prompt Delivery

MOTOR GENERATOR SETS

KW	Make	A.C.	D.C.
800	Wtg.	3/60/13200	240
500	G.E.	3/250/6600	250
500	G.E.	3/160/2300	250
300	G.E.	3/60/440	220
200	G.E.	3/60/440	250
150	G.E.	3/60/2300	275
150	Ft. Wayne	3/60/2300	230
100	Al. Ch.	3/60/440	275
90	G.E.	3/60/440	60
90	G.E.	3/60/2300	60
75	G.E.	3/60/440	125
75	Wtg.	3/60/2300	110
75	Elec. Prst.	3/60/220	125
75	Wtg.	360/220	250
65	G.E.	3/60/450	125
60	Al. Ch.	3/60/2300	110
50	G.E.	3/60/220	250
50	C. Wheeler	3/60/230	240
40	G.E.	3/60/440	125
40	Imp.	3/60/440	250
35	Ideal	3/60/440	125
30	Wtg.	3/60/440	250
30	G.E.	3/60/440	230
25	Watton	3/60/220	97/111
25	G.E.	3/60/240	440
25	Al. Ch.	3/60/240	220
20	L. Al.	3/60/220	230
15	Col.	3/60/440	45
15	F. Morse	3/60/220	250
15	Hert.	3/60/220	180
10	G.E.	3/60/440	220
5	G.E.	3/60/440	125
5	Rel.	3/60/440	125
5	Cr. Wh.	3/50/220	115
5	N. West	3/60/440	220

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Volts	Speed
500	G.E.	IK	440	1200
250	G.E.	IK	440	600
250	Wtg.	TEFC	440	1800
200	Wtg.	CCL	440	1200
150	Cent.		440	1800
150	G.E.	TEFC	440	900
150	G.E.	K	440	1800
150	G.E.	K	440	1200
150	G.E.	IK	440	900
150	Cent.	A	440	1800
125	Al. Ch.		440	435
124	Al. Ch.	AR	220	585
125	G.E.	TEFC	440	1200
100	G.E.	IK	440	600
100	Cent.		440	1800
100	F. Morse	TEFC	440	3600
100	Wtg.	CS	440	720
100	Al. Ch.	AR	440	514
100	G.E.	K	440	1200/900/600/450
100	Al. Ch.	AR	440	495
75	Al. Ch.	AR	220	1765
75	G.E.	K	220	900
75	G.E.	KF	440	1200
75	Cent.		440	1800
75	Wag.	TEFC	440	3600
75	Al. Ch.		440	1130
60	Al. Ch.	AR	440	495
60	G.E.	TEFC	440	1200
60	Wag.	TEFC	440	3600
60	G.E.		440	1800
50	Wag.		440	3600
50	How.	TEFC	440	500
50	Wtg.		220	1800
50	G.E.	IK	440	865
50	G.E.		440	1800
40	How.	TEFC	440	1800
40	U. S.		440	1800
40/15	Linc.		220	850/300
40	G.E.		440	1800
40	G.E.	KT	220	680
40	G.E.	KT	220	855
35	G.E.	IK	440	680
35	G.E.	IK	220	680
35	G.E.	HI	440	575
30	Hert.		440	1800
30	G.E.	KT	220	600
30	G.E.	K	440	1170
30	G.E.	TEFC	440	1200
25	G E.		220	900
25	G.E.	I	220	1200
25	G.E.		440	1200
25/6.2	L. A.	ONS	440	1160/570
25	G.E.	SL	220	1800
20	Linc.		220	1150
20	F. Welch.		440	1200
20	G.E.		440	1200
20	G.E.	KT	220	1750
20	G.E.	KT	440	1170
20	G.E.		440	1800
20	Hert.	MO	440	1200
20	G.E.	KT	440	3600
20	Wtg.	CS	220/440	1165
20/24	G.E.	KT	440	3600
20	Ideal	A	220	1150
10	Wtg.		440	1800
10	Al. Ch.	ARX	440	1160
10	Wag.		220	1730
5	How.	BB	440	1740
5	Wtg.	CCL	220	1700
5	Wesche.	N	220	1800
5	G.E.		440	1800
5	G.E.	KT	440	3400
5	G.E.	TEFC	440	3600
5	G.E.	KT	440	1720
5	Valley		220	1750
5	G.E.	KT	440	1740
5	G.E.	KT	200	1740
5	Wag.		440	1800
5	Wag.	BP	440	1720
5	G.E.	KT	220	1800
5	G.E.	KT	220	1720
5	Valley		440	1750
5	G.E.	KT	440	3450
5	G.E.	KT	440	1200

SYNCHRONOUS MOTORS

H.P.	Make	Type	Volts	Speed
600	Wtg.		440	600
500	G.E.	TS	2300	450
300	Elec. Mtr.		440	900
250	G.E.	TS	2300	600
75	G.E.	ATI	220	900
60	G.E.	TS	220	1200
15	Cent.	IOPE	208	1200
5	G.E.	K	208	1500

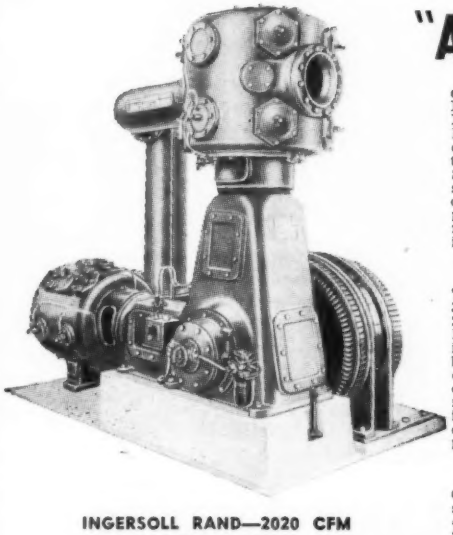
SLIPRING MOTORS

H.P.	Make	Type	Volts	Speed
150	Wtg.	CW	220	1800
100	Wtg.	CW	220	1200
100	Wtg.	CW	220	1800
75	Wtg.	CW	220	1200
50	L. Al.	CH	440	870
50	G.E.	MT	440	1800
40	G.E.	MT	220	1200
40	G.E.	MTC	220	1160
40	G.E.	MT	220	860
40	G.E.	MT	440	860
35	F. Morse	VAV	220	1800
35	G.E.	I	440	1140
35	Linc.	FR	220	900
35	Wtg.	CW	440	1200
30	G.E.	MT	220	570
30	Linc.	FR	220	900
30	Star		440	720/360
30	G.E.	M	440	1150
30	G.E.	MT	220	1745
25	G.E.	MT	440	1125
25	G.E.	I	220	1140
20	Wtg.	CW	440	1850
15	Wtg.	CW	440	600

CHICAGO ELECTRIC COMPANY

1320 WEST CERMACK ROAD **CANAL 2900** **CHICAGO 8, ILL.**

"AIR COMPRESSORS—FROM STOCK"



INGERSOLL RAND—2020 CFM

(Illustrated)

Type: XV HE-2 No. 10640 Size: 26" & 15½" x 13" Speed 300 rpm Arr'g't; Right angle compound 2 stage intercooled & aftercooled. Displacement: 2387 c.f.m. Delivery: 2020 c.f.m. Drive: Direct connected English Electric Synchronous motor Form SMW No. 75525, 375 H.P. 2200/3/60 current. Controls: Push button operated full voltage full magnetic controller with overload and under voltage protection. Full switchboard and interconnected wiring. Separately driven exciter and drive motor with starter for 440/3/60 current. Auxiliaries: Intercooler, aftercooler, air filter assembly, circulating pump, unloader, five step control, spares, wrenches, fittings and some interconnected piping. Receiver if required.

LARDLAW DUNN GORDON—2500 CFM

Type: High & low No. 23467 Size: 30½" & 18½" x 30" Speed 120 rpm Arr'g't.; Horizontal compound 2 stage intercooled. Displacement: 3050 CFM. Delivery 2500 C.F.M. Drive: Direct connected Westinghouse synchronous motor No. 38233 mounted between stages. 500 H.P. 2300/3/60. Controls: Synchronous motor controller, switchboard and interconnected wiring. Separately driven exciter and motor with starter for 440/3/60 current. Auxiliaries: Unloader, intercooler air filter assembly circulating pump, fittings and some interconnected piping. Receiver if required.

BURY—800 CFM

Class CCB No. 851 Horizontal compound two stage intercooled. Displacement: 925 CFM. Delivery: 800 CFM. Speed 150 rpm. Drive: Belt driven from General Electric synchronous motor Type ATI No. 128150. 225 KVA 2200/3/60 current. Controls: Synchronous motor controller, switchboard, direct connected exciter. Auxiliaries: Intercooler, Unloader, Belt, Pulleys, Belt tightener, gauges, oilers.

INGERSOLL RAND—475 CFM

Horizontal compound two stage intercooled. Displacement: 600 CFM. Delivery 475 CFM. Speed 185 rpm. Drive: Belt driven motor optional—to customers specification. Auxiliaries: Intercooler, Unloader, fabricated base.

WORTHINGTON—225 CFM.

No. 5524 air cooled six cylinder two stage intercooled. Displacement: 294 CFM. Delivery: 225 CFM. Speed: 900 RPM Direct connected Glenniffer 3 cylinder diesel engine drive or Electric motor drive to specification.

INGERSOLL RAND—265 CFM

Type V2 No. 58341 tandem compound two stage intercooled combined Diesel compressor. Displacement: 354 CFM Delivery 265 CFM. Speed 330 rpm. Drive: Driven from single cylinder oil engine as integral part of compressor unit. Vertical mounted air cylinders in tandem and horizontally mounted engine cylinder employ single crankshaft. Auxiliaries: Regulator, intercooler, safety valve, gauges.

CANADIAN RAND—150 CFM

No. 5731 horizontal water cooled single stage single cylinder. Size: 10x12. Displacement: 240 CFM. Delivery; 150 CFM. Speed 220 rpm. Drive: Adaptable to belt or direct drive.

AIR RECEIVERS

No. on hand	Diam.	Length.	Working Press.
1	6'— 6"	18'—0"	125 p.s.i.
1	3'— 0"	6'—4"	300 p.s.i.
2	1'— 8"	5'—0"	100 p.s.i.
1	1'—10"	4'—0"	170 p.s.i.

General Machinery LTD

GRANVILLE ISLAND, VANCOUVER, B.C. Tel. PAcific 3487

AVAILABLE FROM STOCK!

PARTIAL LIST FROM OUR CURRENT MOTOR INVENTORY

SQUIRREL CAGE MOTORS — NEW

Qu.	H.P.	R.P.M.	Volts	Description
34	5	1750	220/440	Drip-proof
1	5	1750	550	Drip-proof
3	5	3600	220/440	Drip-proof
1	7½	1200	550	BB
12	7½	1750	220/440	
1	10	875	220/440	SB, Drip-proof
2	10	1750	550	BB
6	10	1750	220/440	BB
1	10	1750	220/440	TEFC, BB
2	10	3500	220/440	
5	15	1200	220/440	BB
1	15	1200	220/440	Hi-torque
5	15	1800	220/440	BB
2	15	3600	220/440	
1	20	865	220/440	BB
1	20	1200	220/440	BB
1	25	865	220/440	BB
1	25	1200	220/440	BB
1	30	1800	220/440	BB
1	50	1200	220/440	BB
2	50	1800	220/440	BB
1	75	1200	220/440	SB
1	125	1750	440	SB

SQUIRREL CAGE — USED
(Reconditioned & Guaranteed)

1	5	900	220	SB
2	5	1200	220	
2	5	1750	220/440	
1	5	3600	220/440	Drip-proof
1	7½	680	440	SB
4	7½	1200	220	SB
2	7½	1750	220/440	BB
3	10	530	220/440	SB
1	10	1200	220	SB
1	10	1200	440	SB
1	10	3180	220/440	BB, Drip-proof
1	15	720	440	SB
1	15	1150	220/440	BB
1	20	1160	220	SB
2	20	1200	440	SB
1	25	720	220	SB
1	25	900	440	
2	30	600	220	SB
1	30	1725	220	SB
2	40	690	220	SB
1	40	850	220	SB
1	40	900	440	
1	50	865	220	SB
1	50	900	2200	
1	50	1200	440	
1	50	1200	220	SB
1	50	3450	220	BB
1	60	1750	220	SB
1	100	690	220	SB
1	150	580	440	SB
1	150	1750	440	

Also many other new and used squirrel cage, synchronous and slip-ring motors from 1/4 H.P. to 150 H.P.

D. C. CONSTANT SPEED MOTORS — USED
(Reconditioned & Guaranteed)

Qu.	H.P.	R.P.M.	Volts	Description
1	1	1150	230	Shunt, SB
1	1	1500	230	BB, Encl.
1	1	1700	230	
1	1½	450/900	230	Shunt
1	1½	685	110	SB
3	1½	1750	230	SB
2	2	415/830	230	Comp.
1	2	1150	115	Comp.
6	2	1200	230	SB
17	3	850/1700	230	Shunt, BB
1	3	1150/2300	230	Shunt, BB
4	3	1150	230	Shunt, SB
2	3	1750	230	Shunt, SB
1	5	225	230	Comp. SB
4	5	320/534	230	SB
2	5	850	230	SB
12	5	1150	230	Comp., SB
3	7½	600/1200	230	Shunt
4	7½	850	230	Comp., SB
1	7½	1100	230	Shunt, BB
6	7½	1150	230	Shunt, SB
1	7½	1750	230	Comp., SB
1	10	625/1250	230	Comp.
4	10	850	230	Comp.
1	10	850	230	Shunt
1	10	1150	230	Comp.
1	15	500/1000	220	SB
1	15	700	230	Comp., SB
4	15	800	230	Comp., SB
2	15	925	230	Shunt, SB
6	15	1150	230	Comp., SB
1	15	1700	230	Comp.
2	20	850	230	Shunt
1	20	975	230	Comp.
1	25	575	220	TE, SB
1	30	1015	230	Comp., SB
1	35	675	230	Shunt
1	50	565	230	SB
1	110	290/580	230	

Also many other new and used D.C. constant and adjustable speed motors from 1/6 H.P. to 150 H.P.

M-G SETS AND SPECIAL CONTROLS BUILT TO YOUR SPECIFICATIONS

A-C SUPPLY CO.

ELECTRIC MOTOR & REPAIR CO.

Division of A-C Supply Co.

1745 FRONT ST. CUYAHOGA FALLS, OHIO

FOR SALE

2200 LB. TRIPLEX

HYDRAULIC PUMPS

IMMEDIATE DELIVERY

Aldrich Pump Co. Vertical Triplex HYDRAULIC PUMPS, 2-¾" x 8", equipped with Herringbone Gears, 67.5 gpm. Maximum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate. Motors are 75 HP, 3/60/220-440 volts, 740 RPM. Complete with starting panel, consisting of G. E. motorstarter switch, push button control, square "D" Switch, and capacitator. Purchased new 3-½ years ago. Excellent condition.

CONSOLIDATED PRODUCTS CO.
INC.
14-17 Park Row New York 7, N. Y.

PUMPS, MOTORS & AIR COMPRESSOR

Large Stock at All Times
of
AURORA CENTRIFUGALS
BARNES CENTRIFUGALS
AMERICAN ROTARY
BLACKMER ROTARY

Rebuilt Pumps in Centrifugals

STEAM & HIGH PRESSURE HYDRAULIC

C & S MACHINERY CO.
715 Howard Street St. Louis 6, Mo.
Garfield 4290

FOR SALE

4—50 KW Murphy Diesel Generating sets, 6 Cyl., 4 cycle, 1200 RPM, Elec. Start, Elec. Machy Co. Alternators, 3/60/120/208 volt, including radiator and panel mounted on fabricated steel base.

3—50 KW Caterpillar Diesel Generating Sets, 6 Cyl., 4 cycle, 900 RPM, Model D8800, direct con. to: 3/60/120/208 volt generators.

3—75 KW Caterpillar Diesel Generating Sets, Model D13000, 3/60/120/208 volt, mounted on steel base, including radiator. All reconditioned.

New Chrysler Diesel Power Units, 75 HP Model IND-3, 6 cyl., Elec Start, includes: 4 Batteries, Radiator, and Spare Parts.

ALJOHN DIESEL CO., INC.
904-10 Pacific St. Brooklyn 16, N. Y.
Sterling 3-6515

TRANSFORMERS

2—500 KVA 60 cy. 1 ph. Allis Chalmers 11,500—460
1—250 KVA G. E. 60 cy. 1 ph. 7800—460
1—100 KVA G. E. 3 ph. 60 cy. 2300—460
12— 75 KVA New Atlantic, 60 cy., 1 ph. 2400—240 120
10—100 KVA New Atlantic, 60 cy., 1 ph. 2400—240 120

ATLANTIC TRANSFORMER CO.
TRANSFORMER SPECIALTIES
5143 N. 2nd St. Philadelphia, Pa.

NEW

SET UP BUT NEVER USED

3—WORTHINGTON 3½ x 18 horizontal duplex Power Pumps with 350 HP, 600 RPM, 3 phase, 60 cycle, 2300 volt synchronous motors, with Westinghouse starters and accessories

PRICED LOW - FOR QUICK SALE

Investigate!

MOREY MACHINERY CO., INC.
410 Broome St., New York, 13, N. Y.

WHAT DO YOU HAVE TO SELL?

We want to buy all types of good used Power Equipment including

BOILERS • TURBO GENERATORS
DIESELS AND DIESEL GENERATORS
TRANSFORMERS • AIR COMPRESSORS
ETC., ETC., ETC.

Whether you are an Owner or a Dealer, you will find it to your advantage to send us full description, specifications and your best re-sale price of any type of Power Equipment you wish to sell.

Our Domestic and Foreign sales of Power Equipment during our Fiscal Year just ending, amount to well over $1,000,000. Prospects are for greater sales-volume the coming year. Our present stocks and sources of supply are seriously depleted, hence this Ad.

Our success is based on small profits and big turnover. Your net re-sale prices to us, therefore, should aid us in continuing this policy.

J. PARKER THOMPSON CO., INC.

507 FIFTH AVENUE, NEW YORK, N. Y. **MU. 7-6547-48-49**

(CUT THIS AD OUT AND SAVE IT FOR FUTURE REFERENCE—YOU NEVER KNOW WHEN YOU WILL NEED IT)

WANTED

1000 to 2500 KW Turbo-Generator, 3 phase, 60 cycle, 440 or 2300 volt, steam pressure 400 psi, 525° F. T.T., extraction 75 psi, with condenser and all auxiliaries to make a complete operating unit.

75,000 to 100,000 Lbs/Hr. Steam Boiler, minimum pressure 450 psi.

W-1203, Power
330 West 42nd St., New York 18, N. Y.

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
MARIEMONT Since 1912 CINCINNATI 27, OHIO

TRANSFORMERS WANTED

usable or burnt-out

IN - STOCK

1—1000 KVA-GE Single Ph.
2—750 KVA-Pittsburgh—Single Ph.
1—30 KVA-GE Constant Current

Zenith Transformer Co.
1733 N. 5th St. Phila. 22, Pa.
Poplar 5-0553

Air Compressors Wanted

Horizontal Water Cooled—Any size also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

FOR YOUR
ELECTRICAL EQUIPMENT

Electric motors, AC and DC
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

Send us list with full details

WIRE OR PHONE
P. O. Box 534

POWER EQUIPMENT CO.
373 SO. GOODMAN ST., ROCHESTER 7, N. Y.
Phone Hillside 2041

Additional
Wanted Advertising
on pages 289 and 320

WANTED

One M. G. Set

150-200 K.W.—125 Volt, Compound Interpole D.C. Generator—Driven by 220-3-60 Synchronous A.C. Motor of suitable size. Manual reduced voltage starter, suitable accessories acceptable.

OHIO VALLEY GENERAL HOSPITAL
Wheeling, West Virginia

KIEMLE OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D. C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D. C. Motors
230 Volts D.C. Motors
550 Volts D.C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

POWER EQUIPMENT

1—2250 KVA, 3 phase, 60 cy., 3600 RPM, Gen. Elec. Turbo Generator, steam pressure 410 lbs. 275° S.H. 725° T.T. with surface condenser.
1—625 KVA, 3 ph., 60 cy., 480 vlt., 900 RPM, Westgh. Generator to a Westgh. non-condensing turbine.
265 new Gen. Elec. transformers 3 to 75 KVA, 450 to 17 vlts.
68 new Gen. Elec. transformers 3300-6600-1100 to 120-240 vlts type HSBA.
1—150 K. W. 125 volts 400 RPM Crocker-Wheeler compd wound, interpole Generator to a 4 cylinder, vertical unaflow Ames engine.
1—360 HP Anderson full diesel, Model 29 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 180 lbs steam pressure 40 lbs back pressure.
1—300 KW, 3 ph., 60 cy., 440 vlt, 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
1—750 KW Gen. Elec. Extraction type Turbine 3 ph., 60 cy., 600 vlt. 150-175 lbs. 10 to 20 lbs. extraction.
1—100 KW, 125 V, type CD1247 General Electric to a 150 HP 3 ph., 60 cy., 220 vlt. type K5572 Gen. Elec. induction motor.
1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt. 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

Send us your inquiries, our stock is continually changing

KEYSTONE
Power Plant Equipment Company

8403 Hegerman St. **Phila. 36, Penna.**

CLEARANCE SALE

UNUSED GASOLINE GENERATOR SETS

4—3 KW, AC, 1 ph., 60 cyc., 115 v. Wisconsin Motor. Spare Parts.
2—7½ KW, Master Vibrator Co., 1 hp., 60 cycle., 120/240 v., 1800 RPM, D.C. Wisconsin Engine. Spare Parts.
2—15 KW, Synchronous "O'Keefe-Merritt" 3 ph., 60 cyc., 220/127 v., 4 wire, 1800 RPM. Continuous Duty. Mounted on Skids. Spare Parts.
1—10 KW, Kohler Co., AC, 1 ph., 60 cyc. 115/220 v., Waukeshaw 4 cycl. Water cooled engine. Skid mounted, sheet metal housing. Spare Parts.

PACKED FOR EXPORT

J. Parker Thompson Co., Inc.
507 Fifth Ave., N. Y. C.
MU. 7-6547-8-9

ENGINE GENERATOR SET

250 KW Croc. Wh. D.C. Gen., Com. Interpole. 125 V. 2000 Amp. 150 RPM. D.C. to Erie Ball high speed non-releasing gear Corliss Eng., 4 valve eng. #6772, size 24 x 27, 100# pres. new 1925. Good con.

PHILA. TRANSFORMER CO.
2829 Cedar St., Phila., Pa.

APPLICATION ENGINEERS

45 KW M.G. Set 2200 AC 250 DC
100 KW M.G. Set 220/440 AC 125/250 DC
285 KW 240 volt Chase Uniflow engine set
200 KW 480 volt Ridgway engine set.
2500 KW 2300 volt G.E. Cond Turbine set
200 KW 1800 rpm 440 volt TEFC Motor

HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

BOILERS

2—400 H.P. Erie City, type E stokers, OHIO PENNSYLVANIA & ASME stamping.
2—400 H.P. Springfield sectional header, oil burners, N. J. & ASME stamping.
2—25,000# B & W Stirling's, unit pulverizers, National Board Stamping.

H. P. BREARLEY
3423-91st Street, Jackson Heights, N. Y.

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

"Export Orders Carefully Executed"

SPECIAL OFFERING

3-2000 KVA Each Transformer Single Phase High Tension
1400/2200 KW Turbo-Generator, non-condensing, Excellent Condition

1— 90,000# Boilers 575#
4—100000# Boilers 300#
1—225000# Boiler 450#
4—1000 H.P. Heine Boilers 225#
2— 825 H.P. B & W Sterling Boilers 200#
2— 600 H.P. Edge Moor 200# Stokers
Smaller Boilers and Fire Tube Boilers also
2—3000 K.W. Turbos @ 350#

Several 425# and 550# Turbo-Generators available
2—2500 K.W. G.E. Co., Turbo-Generator Condensing
2—2000 K.W. G.E. Co., Turbo-Generator Condensing
1—6500 K.W. G.E. Co., Turbo-Generator Condensing
1—2000 K.W. W.E. & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2— 750 K.W. G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units

Non-Conducting Turbos—300—500—750—and 1,000 K. W. & Larger

CHARLES B. REARICK **30 CHURCH ST.** **NEW YORK**

MOTORS • GENERATORS
TRANSFORMERS

25 cy. 60 cy. D.C.

ALL VOLTAGES
1-1500 H.P.

NEW and REBUILT
BOUGHT and SOLD
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

Rebuilt Power Transformers

SINGLE PHASE—OISC

28— 3 KVA Whse. 6000 to 115/230 (new)
3—50 KVA G. E. 33000 to 2300 V.
5— 100 KVA G. E. 22000 to 220/110 V.
6— 200 KVA Whse. 11000 to 440/220 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y.
6— 500 KVA G. E. 13200 to 575 V.
6— 500 KVA Whse. 24000 to 220/110 V.
3— 667 KVA Pack. 11000/22000 to 440 V.
3— 667 KVA G. E. 33000 to 440/220 V.
2—1200 KVA Whse. 66000/2300/4000 Y.
2—2000 KVA Whse. 66000 to 2200 V.
3—2000 KVA G. E. 13200/26000 to 2300 V.
3—2000 KVA Whse. 33000 to 11000 V.
3—2000 KVA G. E. 33000 to 13200/6600 V.
7—4000 KVA G. E. 15950/27600 Y to 13800/6900/4160 V.

THREE PHASE

3— 450 KVA G. E. 66000 Y to 440 V.
6— 850 KVA G. E. 13200 to 2300 V.
1—1200 KVA Whse. 6600 Y to 2300 V.
2—1500 KVA G. E. 13200 to 440 V.
3—1800 KVA G. E. 13200 to 550 V.
1—3000 KVA G. E. 11600 to 440 V.
1—15600 KVA Pitts. 27880 to 4560Y. V.

WATER COOLED-SINGLE PHASE

4—3333 KVA G. E. 25/60 Cy. 6000 to 4000/6925Y 8000/13850
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.
7— 750 KVA Whse. 33000 to 2200 V.
7— 675 KVA Whse. 33000 to 2200 V.

PYRANOL

1—3000 KVA Penna. 25 Cy. 13800 to 480 V. 3 Ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy. 3 ph.

NETWORK TRANSFORMERS

19—150 KVA G. E. type Ht, late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Vault or submersible type; attached to each transformer is G. E. automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.
8—200 KVA G. E. Ditto

STATION-TYPE REGULATORS

4—68 KW indoor type Westinghouse constant current regulators, Type R.S., Prim 2200 V., 60 cy., Amp. 6.6 & 7.5 Serial Number 582020

PHILADELPHIA TRANSFORMER CO.
2829 Cedar St. Phila. 34, Pa.

One (1) 750 H.P. Union Boiler, 250# pres.

One (1) Steel Stack with Breeching.

Westinghouse 7 Retort Stoker.

Forced Draft Fan Turbine Drive

Bailey Meter, Hagan Controls

Copes Feed Water Regulator

Richardson Scales

One (1) 150 H.P., 150# pres. Universal Boiler, Brick Set

Iron Fireman Stoker

JAMES T. CASTLE
424 First Ave. Pittsburgh 19, Pa.

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

HEADQUARTERS FOR D.C. MOTORS!

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-63L
3	7½	850	G.E.	CD-75
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	West.	SK-93
5	15	825	West.	SK-90
3	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK/143
3	75	850	West.	SK-160
1	100	1150	West.	SK-163
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440*	West.	CW-232C
1	5	580	220*	G.E.	HI-9
6	7½	810	550	G.E.	MTC-5201
1	7½ (new)	575	220*	G.E.	MT-522
2	10	1140	440*	West.	HF-7A
2	10	570	220*	G.E.	HI-11
3	11‡	810	550	G.E.	ITC-5008
1	15‡	900	440*	G.E.	MTC-5302
2	15	570	220*	West.	CW-646
1	18	680	440*	West.	MW-316
1	25	1130	550	G.E.	MT-323
2	25	850	220*	Wagner	BR
2	25	720	440*	Wagner	22VBR
1	30	865	440*	West.	CW-646
1	30	850	440*	G.E.	MT-332
1	30	675	440*	G.E.	MT-336
2	35	600	440*	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440*	G.E.	MT-346
1	50	860	440*	West.	HF-12A
5	52‡	550	220*	G.E.	IQC-5013***
1	60	685	440*	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-930-39
1	75	720	550	G.E.	MT-556
1	80‡	575	440*	G.E.	MTC-5352
1	100	1760	220*	Al-Ch..	ARY-223BS
2	125	430	440*	G.E.	IL-16
2	150	1750	440*	G.E.	MTP-549
1	150‡	680	440*	West.	CI-856-C
1	150	385	550	G.E.	IM-17
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
3	250 (new)	360	440	West.	CW-20-53-15
1	300	514	550	G.E.	IM-17A
1	400	505	550	West.	CW

* Can be furnished for either 220 or 440 volts but not both voltages.
‡ Intermittent rating.

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

230 VOLT ADJUSTABLE SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	7ST
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	G.E.	RF-10
1	12½	280/840	West.	SK-130
10 (new)	12½	600	West.	SK-93
1	15	600/1800	Reliance	T-131T
1	15	400/1600	G.E.	RF-11
1	15/20	500/1500	G.E.	CD-95
3	20	400/1600	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	25	500/1500	Reliance	T-230T
1	30	400/1200	West.	SK-163
1	35	500/1500	West.	SK-143
3	40/50	400/1600	Al.-Ch.	EB-147
3	40/50	400/1600	Reliance	T-385T
1	75	500/1500	Cr.-Wh.	CCM
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

CRANE, MILL TYPE, 230 VOLT D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
2	10	690	West.	K-4
1	13	575	G.E.	CO-1806
1	15	630	West.	K-5
2	20	515	West.	K-6
3	25	590	Diehl	TE
2	27	490	West.	MC-40
3* (new)	35*	600	West.	CK-9
1	50	600	West.	CK-9
5** (new)	50**	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.F.	COM-1831AE
4	65	450	G.E.	COM-1830
1	70	440	West.	MC-70

* Available with West Type DW Frame 135F. Style 487555, Shunt Wound Brakes.
** Available with G.E. CR9523B313M2. Cat 823043-G24 Shunt Wound Brakes.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220*	Reliance	AA-B3247
2	20	1160	440*	West.	CS-554
1	25	1140	2200	West.	CCL
1	25	705	440*	West.	CS-W504-TEFC
1	25	690	440*	G.E.	KT-336
1	30	870	220*	West.	CS-646
1	30	1160	440*	West.	CS-644
1	50	900	2200	G.E.	KT-346
1	50	850	220*	West.	CCL
1	75	1750	2200	West.	CS-761
1	100	1800	440*	G.E.	K-E13
1	100	1165	2300	G.E.	IK-E13A
2	100	870	440*	G.E.	KT-356
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	150	1800	440*	Howell	N-684
4	200	580	550‡	G.E.	KT-5668
1	500	1200	440*	G E.	KTP-567
1	700	1800/2300/4000	West.		CS-4-39D-12

* Can be furnished either 220 or 440 volts, but not both voltages. ‡ Reconnectable for 440 volts.

NEW A. C. MOTORS IN STOCK
SQUIRREL CAGE, BALL BEARING
1800 RPM, 3 Phase, 60 Cycles, 220/440 Volts

Qn.	HP	Make	Type
15	1	G.E.	K-203
15	2	G.E.	K-224
15	3	G.E.	K-225
15	5	G.E.	K-254
10	7½	Al.-Ch.	AR-284
7	7½	G.E.	K-284
6	10	G.E.	K-324
2	20	G.E.	K-364

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment Is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
4521 HAMILTON AVE. CLEVELAND 14, OHIO

EIGHT SPECIALS

Such as we must remove promptly from present foundations and priced specially low for quick sale

DIESEL UNIT. 375 KVA GE 3-60-480 v. with Fairbanks Model 32E-14 engine, 300 RPM. Like new. Seen operating.

DIESEL UNIT. 375 KVA GE 3-60-2300 v. Worthington.

TURBO UNIT. 2500 KVA GE 3-60-480 v.; non-condensing.

TURBO UNITS. Two 250 KVA GE 3-60-480 v.; non-condensing-bleeder.

BOILERS. Two 250 HP Murray 200#, oil burners.

DIESEL UNIT. 185 KVA Fairbanks 3-60-2400 v.; Model 32E-14. Seen operating.

TURBO UNITS. Two 1250 KVA Elliott 3-60-480 v.; condensing-bleeder. Surface condensers.

TURBO UNITS. Two 1875 KVA GE 3-60-2300 v. condensing. Surface condensers.

WIRE OR TELEPHONE

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

BOILERS

2—1047 HP Heine Boilers 200#
4—1010 HP Heine Boilers 200#
2— 786 HP B. & W. Stirling 180#
2— 750 HP B. & W. Stirling 190#
1— 650 HP Casey Hedges 225#, 1932
1— 519 HP Titusville 3 drum Boiler 200#
2— 404 HP Springfield Sec. Header Boilers 200#
3— 318 HP B. & W. Stirling Boilers 200#
1— 216 HP Vogt 3 drum Boiler 160#
1— 80 HP Cyclotherm Steam Generator 125# (New)
1— 40 HP Leffel Scotch Marine Boiler 125#

TURBINES

1—750 KW Westinghouse Turbo Generator, 250# pressure, 100° superheat, 2300 volts, all auxiliaries, recently rebuilt.
1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
1—750 KW 3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—500 KW General Electric Condensing Turbine
1—2000 KW General Electric Condensing Turbine.

DIESEL ENGINES

1—350 KW Chicago Pneumatic—480 Volts—New.
2—100 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.
5—100 KW General Motors Diesel Engine Generator Sets, 110-240, D.C. new 1942.
4—300 KW General Motors Diesel Engine Generator Sets, 110-240, D.C. new 1942.

ENGINE GENERATOR SETS

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine Generator.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.
1—450 KW Skinner Uniflow Engine Generator, 2300 volts, 14 years old.

SPECIAL OFFERING:

1—650 HP Casey Hedges Water Tube Boiler, 225# pressure, complete with all Trim Copes Regulator, Combustion Engineering Stoker. Boiler new 1932. Available for immediate shipment.

SEE Fletcher FIRST!

FLETCHER SALES CO.
325 Fincastle Building — LOUISVILLE, KY.

SYNCHRONOUS ROTARY CONVERTERS

Qu.	KW	Make	Speed	D.C.V.
1	500	Whse.	1200	600
1	300	Whse.	1200	275
2	300	Whse.	1200	600
1	300	G. E.	1200	600
2	175	Whse.	1200	275
1	175	G. E.	1200	275

TRANSFORMERS

1—200 KVA Kuhlman, Cont. Duty, Auto. 3800-2300/3/60.
3—37½ KVA Pitts. Cont. Duty, Auto. 6900-2300/1160.

MOTORS

1—80 HP. 1200 RPM, Cr. Wh. 220/440/3/60 Ind.
1—75 HP. 1800 RPM. U. S. Line Start 220/440/31 60 Ind. B.B.
1—65 HP. 1200 RPM, G. E. type KT. 220/440/3/60 Ind.
1—40 HP. 900 RPM, Whse. type CW, 440/3/60 Slip Ring.
5—5 HP. 2200 RPM. Reliance Ex. Proof, 230 V. D. C.
Several Whse. type SK, 230 V. D.C. 5, 7½, 10 and 15 HP. New TEFC and standard open ball bearing AC motors available. Across line and reduced voltage starters.

Electrical Equipment

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers

C. B. LOCKE CO.
P. O. BOX 3227
TEL. 38-136,
CHARLESTON, W. VA.

NEW and REBUILT

MOTOR GENERATOR SETS

Complete with Control Equipment

3—150 KW, 900 RPM, 250V, DC. to 225 HP 2300V. A.C. Syn.
2—150 KW, 900 RPM, 600V. D.C. to 225 HP 2300V. A.C. Syn.
1—200 KW, 900 RPM, 250V. D.C. to 300 H.P. 2300/4000V. A.C. Syn.

TURBO ALTERNATORS

Complete with Auxiliaries and Control Equipment.

1—3650 KVA 3600 RPM, 2300/3/60, Whse.
1—3125 KVA 3600 RPM, 2300/3/60, Whse.

NEW ALL BRONZE CENTRIFUGAL PUMPS

3—30-45 G.P.M. 30 to 80' Head, 1½" dis. WESTCO Ball Bearing, with Bases and Couplings for motors.
3—30-85 G.P.M. 30 to 87' Head, 1½" dis. WORTHINGTON MONOBLOC—2 H.P. 3 ph., 3450 RPM Tot. Enc. Fan Cooled Motors.
1—150 G.P.M.—60' Head, 1½" dis. Fig. 5530 FAIRBANKS MORSE, with Base and Coupling for Motor.

IN PHILA. Stock—Immediate Shipment

DELTA EQUIPMENT CO.
148 N. 3rd St. Phila. 6, Pa.

DIESEL GENERATOR UNIT

1500 H.P.—1250 KVA

Nelseco — General Electric
Modern, Supercharged, Bosch Injection
3/60/2400, 300 RPM, All Accessories, Complete
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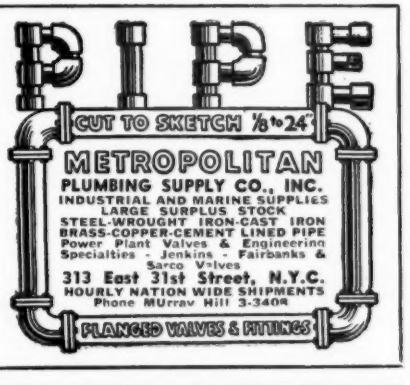
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P. F.	.80	Cycles	60
Volts input	115. D. C.	Volts output	120. A. C.
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HP	Volts	Make	Speed
200	2200/440	G.E.	600
150	2200/440	G.E.	600
150	440/220	Whse.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E. MTC	900
100	550	G.E.	900
80	440/220	G.E. (MTC)	900
75	440/220	G.E. (MTC)	600
60	440/220	G.E.	1200
50	2200/440	G.E.	600
50	440/220	G.E.	900
75	550	G.E.	900
40	440/220	G.E.	720

SYNCHRONOUS MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Type	RPM
250	440/220	Whse.	HR	277
110	440/220	G.E.	TS	257
600	4000/2300	Cr. Wh.	SYN.	900
500	4000/2300	Cr. Wh.	SYN.	900
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN.	900
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
125	2300	G.E.	TS	327
110	440/220	G.E.	TS	1800
100	440/220 25 cy.	G.E.	TS	375
100	440/220	Whse.	G	1800
90	440/220	G.E.	ATI	1200

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HP	Volts	Make	Type	Speed
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400	550	G.E.	IK	720
300	440/220	G.E.	IK	720
200	440/220	Whse.	CS	600
200	440/220	G.E.	KT	600
200	2200/440	G.E.	IK	1200
150	440/220	Howell	B. Brg.	1800
125	440/220	G.E.	IK	720
100	440	G.E.	IK	450
100	2200	G.E.	KT	511
100	440/220	G.E.	KT	720
75	2200	G.E.	IK	1800
75	220	G.E.	KT	1200
60	440/220	G.E.	KT	1800
50	550	Whse.	CS	3600
50	440/220	G.E.	FTR	900

A. C. GENERATORS

1—450 kva., 900 rpm., 440/220 v., G.E.
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1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 600 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 rpm., 440/220 v., G.E.

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1—100 kw., 125 v., 1200 rpm. Whse., conn. to 150 hp. 440/220 v., 3 ph. syn. motor.
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1—25 kw., 440/220 v., 1800 rpm. G.E. alternator conn. to 40 hp. 230 v., DC motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
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have been used for pumping #6 fuel oil

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Coal Handling Unit

One Robins coal handling unit with crusher, chain and bucket elevator, 100 ton bin complete with scale and lorry.

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2—Combustion engineering marine type boilers, 32,000 lb. Steam/Hour Normal Rating. Brand new, never assembled. Complete with super heaters, air heaters, water walls, all trim, brick-work, casing, etc. Todd oil burners and Todd oil heater pump set. Hagan Combustion Control.

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1—Westinghouse turbine generator set, 2000 KVA, 480 volts, 60 cycle, 3 phase, 3600 RPM complete with surface condenser and pumps for use with 175 lb. dry steam.

1—500 KW Allis-Chalmers, 480 volt, 3 phase, 60 cycle engine driven generator with belted exciter direct connected to 120 RPM Hoover-Owens-Rentschler cross compound steam engine with surface condenser and pumps, for use with 175 lb. dry steam.

These sets are located in Akron, Ohio.

Purchaser to visit site and submit bid for equipment in place—Purchaser to immediately remove equipment after sale.

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1—Fairbanks-Morse Stationary Power Diesel Electric generating set complete including all auxiliaries 300 HP, 250 KW, 250 volt direct current generator, 257 RPM. This engine is in operation at Rockford, Illinois. Purchaser to visit site and after inspection to submit bids for engine in place. Purchaser to immediately remove engine and its direct auxiliaries after sale.

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Sizes from 25 HP to 500 HP Slip Ring, Squirrel Cage, & D.C.

400 HP Westinghouse slip ring motor, type CW, frame 1108, 3 phase, 60 cycle, 2200 volts, 514 RPM.
300 HP Allis Chalmers motor, 3 phase, 60 cycle, 2200 volts, 514 RPM.
300 HP G. E. type MT, 3 phase, 60 cycle, 440 volts, 514 RPM, slip ring motor, complete with starting equipment.
250 HP G. E. slip ring motor, 3 phase, 60 cycle, 2200 volts, 600 RPM.
250 HP Westinghouse, type CS, 3 phase, 60 cycle, 2200 volts, 1200 RPM.
200 HP Westinghouse slip ring motor, type MW, 3 phase, 60 cycle, 440 volts, 600 RPM.
200 HP G. E. type MT, 3 phase, 60 cycle, 2200 volts, 435 RPM.
200 HP G. E. 3 phase, 60 cycle, 2300 volts, 514 RPM, synchronous motor.
75 HP G. E. 3 phase, 60 cycle, 220 volts, 1800 RPM, squirrel cage motor.
4—50 HP Westinghouse, Squirrel Cage motor, type CS, 3 phase, 60 cycle, 440 volts, 900 RPM.

100 HP DC Reliance 230 volt motor, 400 to 1200 RPM compound wound, sleeve bearing.

150 HP Electro-Dynamic 230 volt DC, 250 to 500 RPM, compound wound, 3 bearing, complete with controls.

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RHinelander 4-6478

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1—16" Treadwell Cutting Off Machine
1—12" Treadwell Cutting Off Machine
1—Sirroco Blower 24 FS—300 C.F.M. with motor
1—Robinson Blower Type H—24x96
2—#7 Buffalo Blowers—12,000-18,000 C.F.M.
1—5/16" B-R-S Tapping Machine ¼ H.P. motor
1—3/16" B-R-S Tapping Machine ¼ H.P. motor
2—5 ton Ingersoll Rand Ind. Type Air Hoists
1—Prentiss Drill Press #3 M.T. with motor
1—4000 # Erie Drop Steam Hammer Double Drop Frame
1—#471 Billing & Spencer Board Forge Hammer
1—Chicago Pneu. Air Compressor 17 x 10 x 12—154 C.F.M.—100 # Pres 150 H.P. motor 3/60/2200 Complete with Panel & Tank
1—Allstate #2 Double Punch & Shear
2—48" H.D. Morton Shapers Vert. & Horiz. Table Adjustments
1—Newton Type U-82-A H.D. Cold Saw
2—#11 S Automatic Saw Sharpening Machine
1—B.S. Press 250 x 89 ton Horiz. Hyd. Draw Bench. 174" Stroke
1—Morgan Guillotine Plate Shear #132"—120"x 1½"—Throat 26" Ser. 187—75 HP motor
1—74" Stamco Brick Siding Machine 20⅛" diameter Feed table
1—Smith 14-S Cement Mixer
5—Coal Hoppers—8½ yd. cap.
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Will Accept Reasonable Offer

Mfg.	Suction Discharge	Dia. Casing
Advance 6SH, 1100 gals. 65'	8¾"	21"
Alberger, 2 stage turbine	2"	15"
Dayton turbine, 250 gals. hd. 50 lbs.	4"	15"
Gould 4H	4½"	20"
Thomas, 3 stage	1"	10"
Worthington	2½"	20"
Lawrence (2)	4"	16"
Quimby Screw	2"	
Rumsey plunger		

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34 Jumel Place, **New York 32, N. Y.**

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PLUMBING SUPPLY CO., INC.
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Type 2 BY 99 horsepower

Steam Pressure 87.5 pounds gauge
Exhaust Pressure 8.0 pounds gauge
Turbine 4682 RPM, Gear 1760 RPM

Steam separator & governor included

In use only 5700 hours.

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100 H.P.

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One Johnston Bros. No. 14 boiler 150# W.P., A. S. M. E. code, eight months old operated four months on canning process. Factory check-up at close of season. Complete with standard auxiliaries plus water return system, blow-down tank, transformers f. o. b. Muskegon.

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TERRE HAUTE, INDIANA

Hydro-Electric Specialists

We offer subject to prior sale

2—400 KW 2 bearing horizontal alternators, one 3 phase 60 cycle 2300 V and one 3 phase 60 cycle 440 V, both 180 RPM
1—150 KW vertical 3 phase 60 cycle 2300 V 164 RPM Like new.
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Horizontal direct connected units of various sizes.

We buy and sell.

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MONSON, **MASS.**

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3—H.R.T. Boilers—75 H.P.—E. Leonard & Sons—complete with all Mountings, Saddles, etc. Two of these boilers are equipped with Iron Fireman worm type Stokers.
2—Feed Water Pumps (Steam Driven)—i.e., 1—Horizontal (Worthington) 6x6x5; 1—Upright (Hepburn) 7x5x12.
1—H.W. Receiver—cast iron—approx. 50 gal.
1—Flow Meter—24 Hr.
1—C.O.2 Meter—24 Hr.
1—Boiler Pressure Recorder—24 Hr.
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This Power House has been operating until recently; but will be sold as is and where is.

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100 KW General Electric, 125/250 V. Type RC. 525 RPM, 2 bearing-Switchboard.
75 KW Western Electric, 125/250 V. Type RC-37, 750 RPM, 2 bearing.

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Fleming piston valve, side crank steam engine. Direct connected to G.E. Type A.T.B., A.C. generator, 3 phase, 220 volts, 315 amps, 120 K.V.A., 225 R.P.M.
Rugged type generator, will stand considerable overload.

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Unit complete with: Switchboard, Exciter, Oil Clarifier, Starting Air Compressor, Pumps, Piping and Fuel Tank.

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DIRECT CONNECTED TO: FAIRBANKS MORSE DIESEL ENGINE, MODEL NO. 32, 240 HP, 4 CY. 257 RPM.

UNIT COMPLETE WITH: SWITCHBOARD, EXCITER, OIL CLARIFIER, STARTING AIR COMPRESSOR, PUMPS, PIPING AND FUEL TANK.

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Immediate delivery—inspection near Louisville, Kentucky

Westinghouse Turbo-generator

with jet condenser

200 K.W. at 80% F.F., 3/60/440, Serial #14866. Good condition.

Four Strong-Scott B-18 Coal Pulverizers

Two with motors 3/60/440. Two without motors. Good condition. We are replacing with larger mills of the same make.

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Incorporated

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Never Used Tested and Stamped
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Working Pressure—125 Lbs. per sq. in.
Heating Surface—1516 Sq. Ft.
Rated H. P.—126.3
Length overall—25'10"

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Alliance, Ohio Phone—6218

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3/4	1750	208	3	G.E.-KT
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3	1800	220	3	Cleveland
3	1800	220	3	G.E.-KT
3	560	220/440	3	Wagner RP
5	1725	220	3	R-M
7½	1750/1140/875/565	220	3	West. CS
15	700/180	440	3	West. tand.

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Detroit Underfeed Stoker

New in 1942

Used on 150 HP Boiler

Job No. JS1484 Stoker No. J1938

Any reasonable offer will be accepted.

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DIESEL ENGINES

(1) GM Mod. 8-268A 550 H.P. Direct Connected to 300 KW 120/240 D.C. Generator. Built in 1945. Condition like new.

(6) Buda 90 H.P. 6 Cylinder Engines Direct Connected to 1000 GPM Pumps. 230' Head (New).

(2) Hercules 100 H.P. 6 Cylinder Engines. Pumps same as above.

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1803 E. 21 St. Cleveland 14, Ohio

Phone CHerry — 5292

WANTED

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FALK GEAR REDUCER

Model 461, size 11DB1, ratio 6.391 - 250 H.P. 1150 RPM. Red. to 180. Serial # 1894927-1704298

SCOTT PAPER CO.

MR. E. BROOMALL
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1—200 H.P. Erie City Fire Tube Economic Boiler with Detroit Underfeed Stoker and Cochrane Deaerating Heater.

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Medium or High Speed

Diesel Generating Set

2400 volt, 3 phase, 60 cycle, 140-180 KVA, new or good rebuilt. Prefer Semi-Portable.

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USED ONLY FOR SHORT WHILE

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1038 H.P., 200 p.s.i. Springfield sectional straight tube boiler with pulverized coal equipment, fan, etc., in operating condition. Write F. J. Kerns, Mgr., Electric Light & Power Dept., City Building.

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BRASS, COPPER NICKEL, ADMIRALTY, ALUMINUM BRASS

5/8" OD & 3/4" OD

New, Prime, Government Surplus

40% BELOW MILL PRICE

SABIN METAL CORP.

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Walker 5-6583-4

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Due to heavy additional power requirements a completely new plant is being installed. For that reason the entirely useable equipment indicated below is thereby being made available for sale.

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5—D. M. Dillon return tubular, Mass. Standard Construction, 124-3"x16' tubes, approximately 1626 st. ft. heating surface, rated 162 H. P. Complete with accessories.

Each equipped with Westinghouse 78 (E)x6'1½" steam engine drive stokers with automatic regulator valves and AK-2 Wing blowers.

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1-Horizontal single cylinder steam engine, rated 250 H. P. 20" bore, 48" stroke, single eccentric valve gear, Flyball governor, 15' diameter flywheel, outboard bearing Rochester improved automatic oiler, Monarch engine stop with 2 push button stations.

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1-Westinghouse stator and revolving fields (less shaft) 900 KVA, 864 amp., 3 phase, 60 cycle, 400 RPM. Spare for above generator.

1-General Electric 300 KVA, 289 amp., 240 KW, 3 phase, 60 cycle, 600 volts P.F. 80% 720 RPM, Type A TB-10-300M-720 Form P. B., with exciter Model No. 304614 Ser. IS 350085-2. Complete with 2 panel switchboard and voltage regulator.

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1-Morris boiler feed pump, size 2-3-4A, driven by 30 H. P. Westinghouse 550V-3 phase 60 cycle motor complete with autor starter.

1-Worthington boiler feed pump 4 DS Turb. driven by 35 H. P. Terry turbine.

Early Fall delivery.

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One 175 HP Allis Chalmers Corliss Single Cylinder Steam Engine; 14′ x 30″ Flywheel; Mechanical Oiling System; Excellent Condition. Immediately Available.

One 160 HP H.R.T. George F. Motters Boiler; 68/4″ tubes, completely retubed April 1947; 100 lb./sq. in. steam pressure; very good condition. Available promptly.

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INCORPORATED
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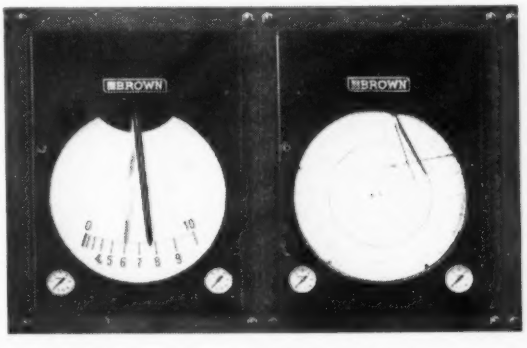

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1—Volt Regulator
1—Bolted Exciter

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FOR SALE

1—750 KVA, 2300/440/220 V. GE Generator Direct Connected to
1—28" x 32" Unaflow Engine
Dir. Con. Exciter
Generator Panel—All complete
Attractive price—immediate delivery
FS-1315, Power
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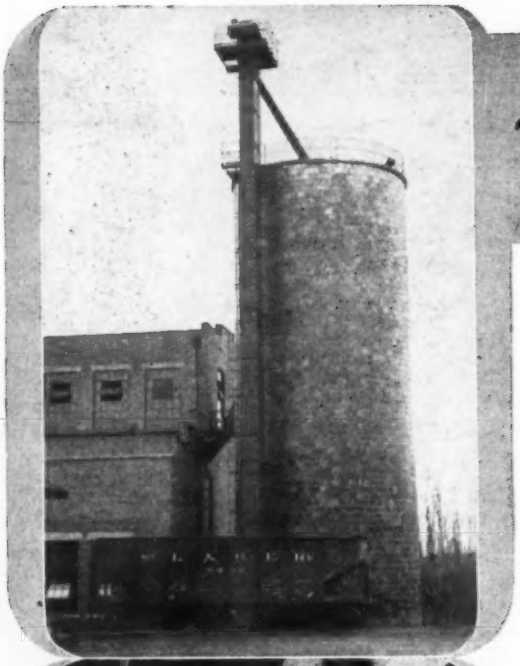

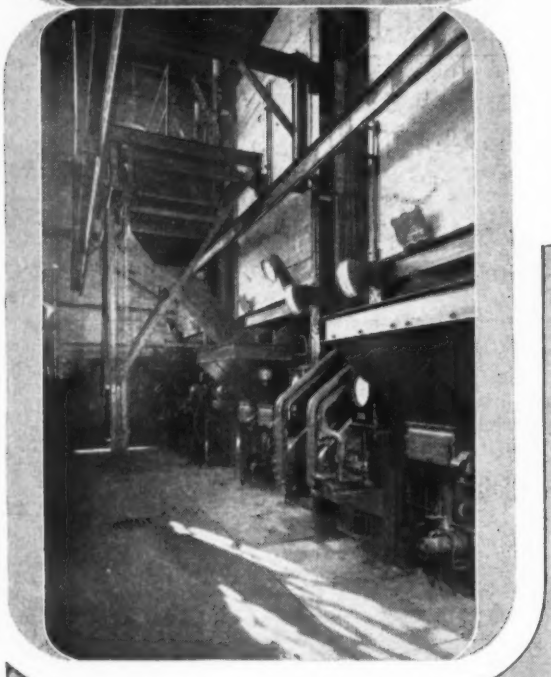

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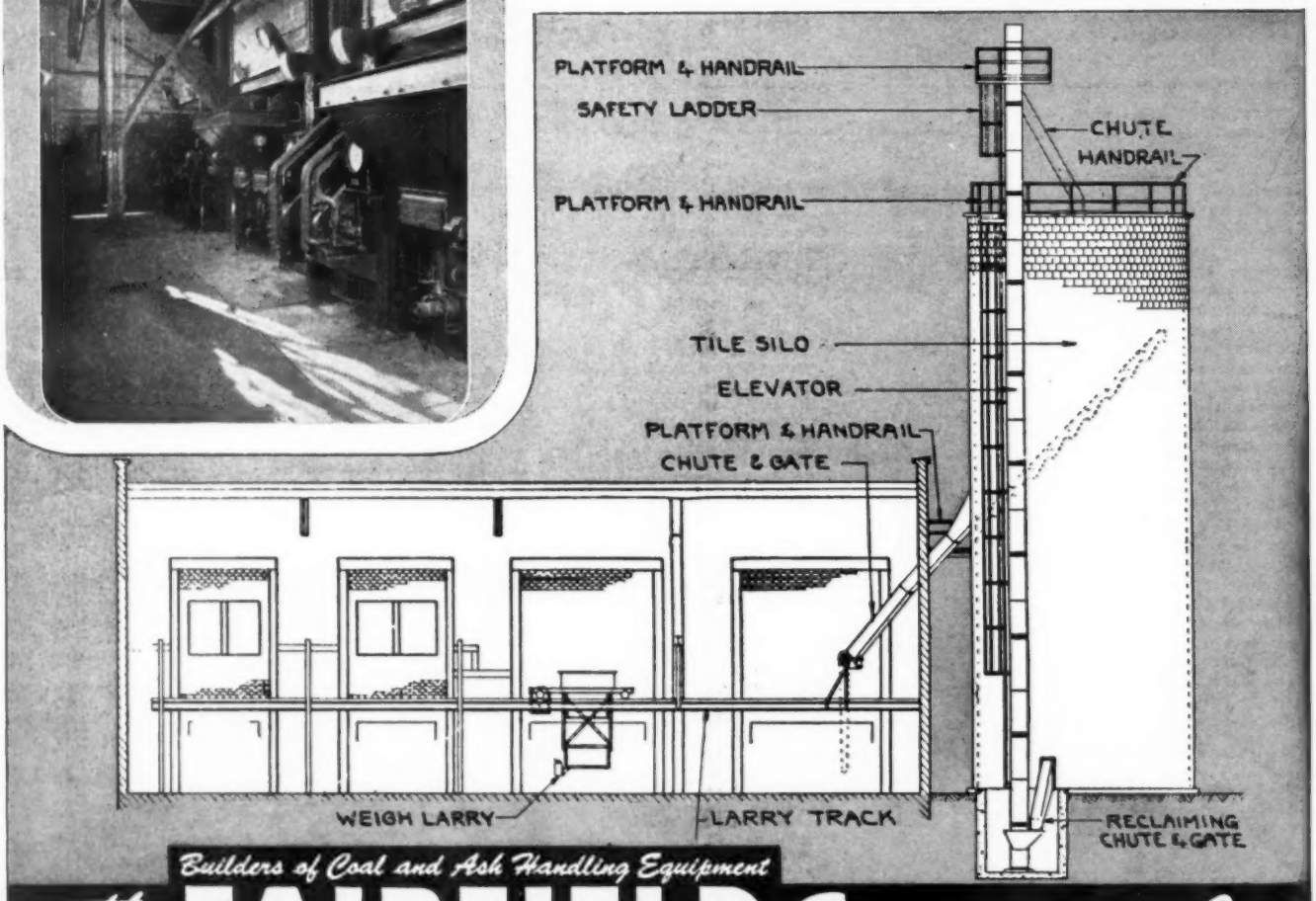

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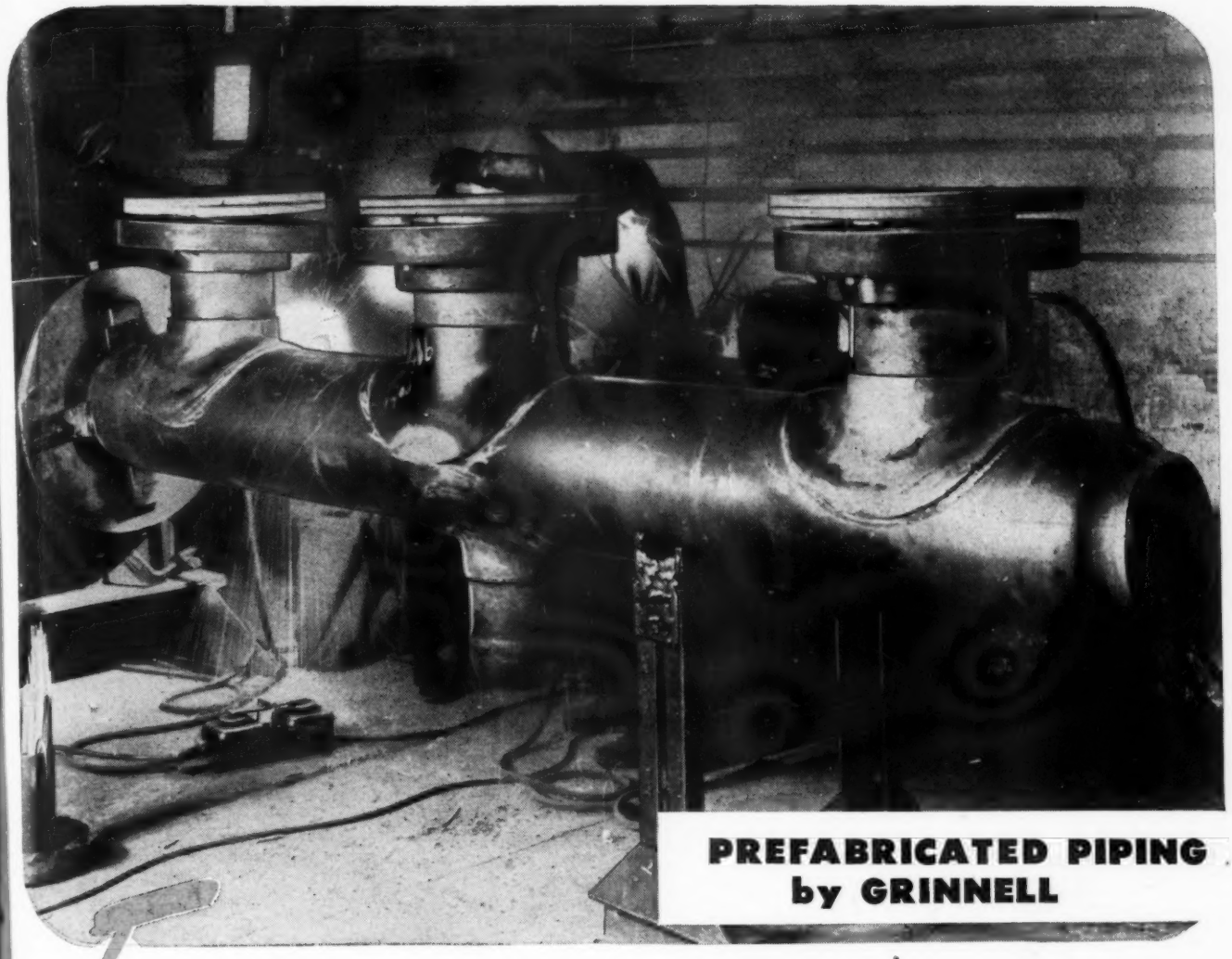

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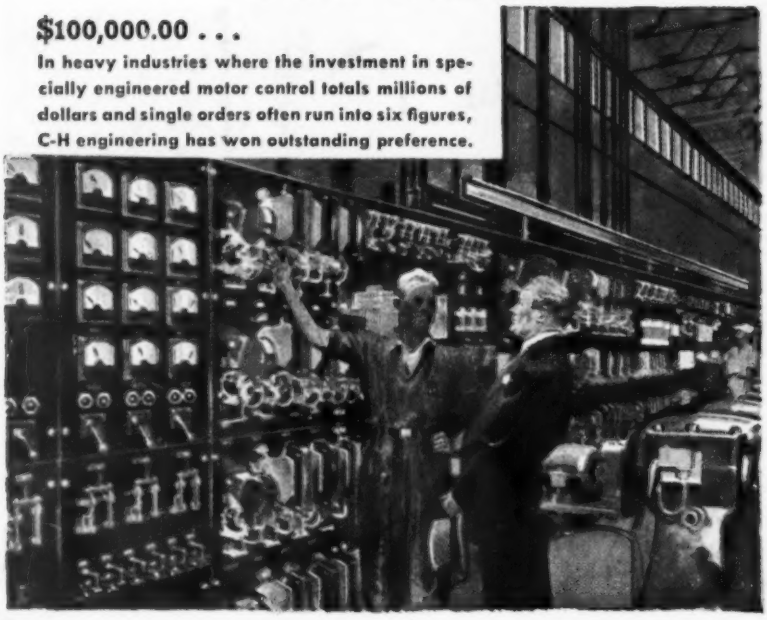

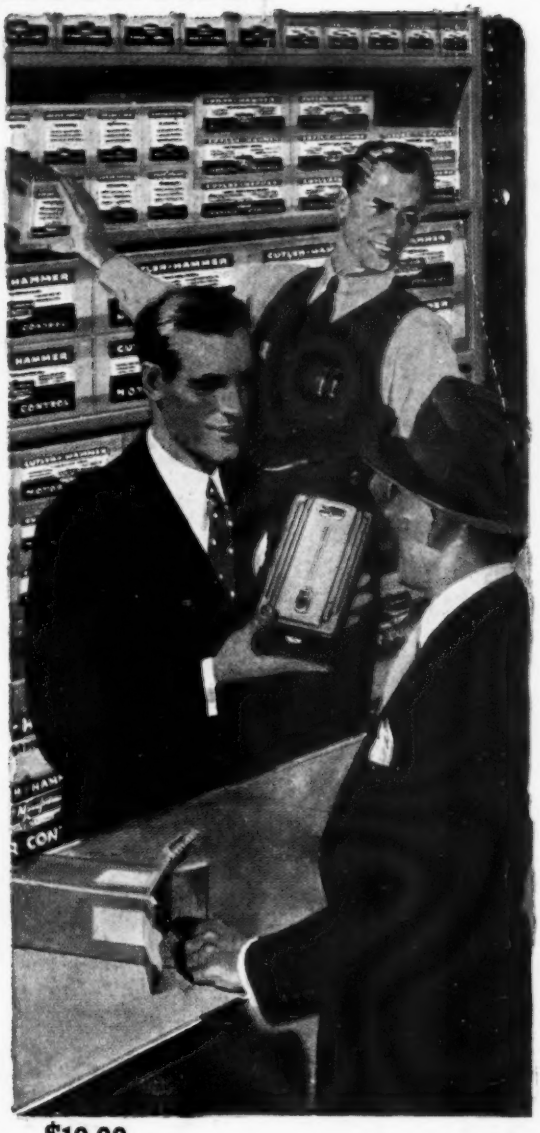

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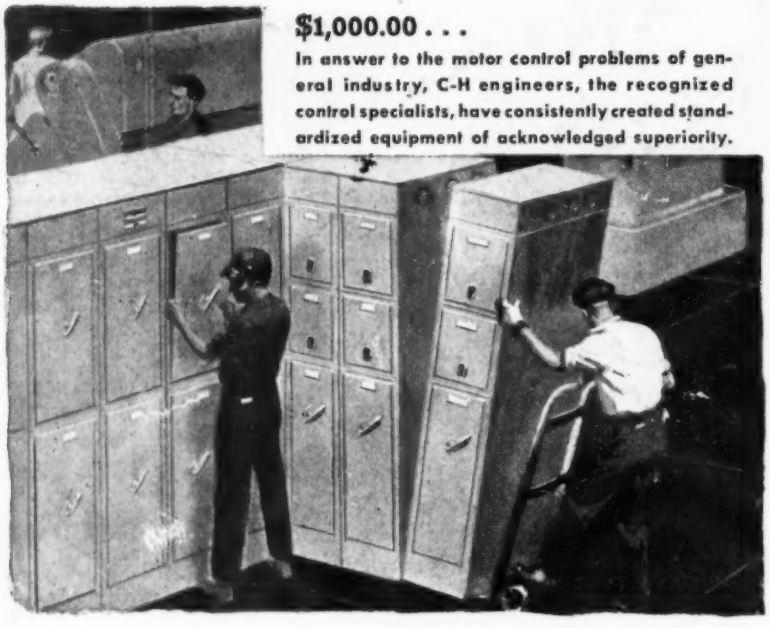

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